Settling the Thermal Frontier:
The Tropical House in Northern Queensland
From Federation to the Second World War.

A Thesis Submitted to
the University of Sydney
in Fulfilment of Requirements for the Degree of
Doctor of Philosophy

School of Architecture, Design & Planning

by

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Sydney, New South Wales

2017
Attribution Statement

This is to certify that to the best of my knowledge, the content of this thesis is my own work. This thesis has not been submitted for any degree or other purposes.


I certify that the intellectual content of this thesis is the product of my own work and that all the assistance received in preparing this thesis and sources have been acknowledged.

Daniel James Ryan

February 8, 2017
As supervisor for the candidature upon which this thesis is based, I can confirm that the authorship attribution statements above are correct.

Associate Professor Lee Stickells,

08 February 2017
Abstract

This thesis examines how the thermal performance of the house in tropical Queensland became, during the first half of the twentieth century, an issue located between politics, medicine and architecture. Drawing from medical history, settler-colonial studies and environmental design history the work is concerned with the mobility of architecture’s agency in solving the “problem” of climate at the domestic scale, and how the control and measurement of residential indoor temperatures were racialised, politicised and medicalised. The chapters trace the development of a common culture within medicine about tropical housing design, the role of northern Queensland as a counter-case to other colonial housing models, the emergence of the white settler housewife as a privileged subject of housing reform and the eventual accommodation of a physiological world view in Australian architectural practice.

The thesis integrates primary source material from an extensive range of medical, governmental and community organisations. It argues that a distinctive medical and political discourse developed during the early twentieth century regarding the tropical house in northern Queensland. While official discussions about housing in the rest of the tropical world centred on the provision of health and comfort for male colonial officials, the control of indigenous and colonial interactions, and the sanitation of labourers’ housing, this was only partly true in northern Queensland. Officials and community groups in Queensland were more focused in their efforts on the white rather than indigenous or indentured migrant populations. Of most concern was the question of how to make white women more productive, comfortable and healthier at home; questions about domestic productivity and reproductivity of settler housewives were framed both as an environmental and architectural issue with political consequences. The thesis argues that this was driven by racial anxieties about white women’s role in the tropics, emergent research on the physical limits to work in high temperature environments and northern Queensland’s unusual socio-political form, being a settler-colonial society located in the tropics. Far from seeing climatically responsive design as a recent phenomenon, the study highlights the deep historical links between architecture, climatology, medicine and the politics of regional development—all bound to the history of the dual enterprises of colonisation and settlement.
The thesis tracks the evolving thinking about the tropical house and architecture’s fluctuating agency therein. It demonstrates that debates about tropical housing in the early twentieth century were not driven by architects but by medical experts, women’s groups and politicians. Even where architects played a major role in shaping discussions on housing, such as at the end of the Second World War, they were still reliant on medical and economic research to frame questions about how buildings ought to respond to climate. Here, the thesis emphasises how, in the specific setting of northern Queensland, architecture drew from and normalised knowledge from other disciplines in order to reshape itself and secure an ongoing role in the discourse on the tropical house in Australia. As such the thesis makes a contribution to the ongoing reassessment of the relationship between architecture, climate, and the colonial project; and to the historiography of architecture’s response to environmental politics and thought.
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<tr>
<td>ABJQ</td>
<td>Architectural and Building Journal of Queensland</td>
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<td>AWC</td>
<td>Allied Works Council</td>
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<tr>
<td>AITM</td>
<td>Australian Institute of Tropical Medicine</td>
</tr>
<tr>
<td>AWC</td>
<td>Allied Works Council</td>
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<tr>
<td>BHIC</td>
<td>Barracks and Hospital Improvement Committee</td>
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<tr>
<td>BWC</td>
<td>Brisbane Women’s Club</td>
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<tr>
<td>CEBS</td>
<td>Commonwealth Experimental Building Station</td>
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<td>CHC</td>
<td>Commonwealth Housing Commission</td>
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<tr>
<td>CWA</td>
<td>Country Women’s Association</td>
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<tr>
<td>CSIR</td>
<td>Council for Scientific and Industrial Research</td>
</tr>
<tr>
<td>EIC</td>
<td>East India Company</td>
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<tr>
<td>NAA</td>
<td>National Archives of Australia</td>
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<tr>
<td>PHA</td>
<td>Public Health Association</td>
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<tr>
<td>PWD</td>
<td>Public Works Department</td>
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<tr>
<td>QCWA</td>
<td>Queensland Country Women’s Association</td>
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<tr>
<td>QBI</td>
<td>Queensland Bureau of Industry</td>
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<tr>
<td>QIA</td>
<td>Queensland Institute of Architects</td>
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<td>QSA</td>
<td>Queensland State Archives</td>
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<tr>
<td>QTHC</td>
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Introduction

Over three weeks in May 1919, a series of articles on ‘Tropical Australia and its Settlement’ framed the process of populating Northern Australia as a set of three interconnected problems to do with climate, physiology and technology. The final article discussed how an unfamiliar climate necessitated changes in habits, clothing, food and ways of organising and constructing buildings. These articles were not written by a couturier, chef or architect. They were published almost 100 years ago in the *Medical Journal of Australia* and were written by Anton Breinl, the Austrian-born director of the Australian Institute of Tropical Medicine (AITM), and his Australian colleague, W.J. Young, a well-regarded physiologist of national repute. Both men were based in Townsville, Queensland, then a port city of barely 20,000 people.

Breinl and Young were summarising the medical case in relation to whether Europeans could work and reside permanently in the tropics. They discussed the latest attempts to assess the relative comfort of different locations and any potential effects on health and productivity. For any architect reader today, the arrangement of the articles appears strangely familiar, as if they have been culled from the latest missive on building for climate change. They too were replete with survivalist anxiety, climate statistics and graphs, and even included a building plan. Yet this was medicine at the service of a racialist ideal of nation building—what Breinl and Young referred to as “the Great Experiment of White Australia”—in which architecture was co-opted to reduce the burden of discomfort of what was still considered to be an inclement climate for Europeans.

The parallels between an earlier medical discourse on race, climate and architecture and the current architectural discourse on building for climate change raise a number of questions about the role given to architecture to mitigate environmental risks to society.

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When climate appears unpredictable or to be threatening a way of life, how do experts, those in power and those directly affected expect architecture to respond? During the White Australia period, how were the political problems of settlement turned into technical problems? In what way was architecture seen as part of a racial experiment? What role did it actually play? What traces from this medical discourse on tropical architecture are still present and why have they been so persistent?

As the title *Settling the Thermal Frontier* suggests, this thesis is concerned with the tropics as a thermal and territorial boundary in north-eastern Australia and the role architecture was expected to play in stabilising the European population there. Located at the intersection between the history of architecture, medicine and colonialism, the thesis attempts to tease out the biopolitics of the tropical house in a settler society. Unlike many regional histories of the Queensland House, it does not concern itself with why different forms and traditions of housing existed in Queensland compared to the rest of Australia. Nor does it investigate indigenous perspectives on the settler house, in large part due to the lack of indigenous voices in the archival material. The settler houses that I am examining largely eliminated any indigenous presence.

Rather, the purpose of the thesis is to explore how the design of the tropical house brought together ideas about comfort, climate, health and productivity and to understand, on the basis of this research, the influence of this debate on the politics of tropical development. While it expands on the recent wave of genealogies of tropical architecture, and is indeed

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3 Queensland architectural historians have been particularly preoccupied with searching for origins of regional difference, in particular the high stumped house. Donald Charles Roderick, "The Origins of the Elevated Queensland House" (The Univeristy of Queensland 2004); Peter Bell, *A History of the Queensland House* (Adelaide: Historical Research, 2002).


5 On genealogies of tropical architectures see 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); Iain Jackson, "Tropical Architecture
indebted to their framing of tropical architecture as a form of ‘power-knowledge’, it argues that the specific form of colonisation in Australia and patterns of settlement and dwelling that gave it shape in Queensland influenced the discourse surrounding the tropical house. By focusing on the first half of the 20th century, when the newly federated Australia attempted to concoct a racially homogenous settler body, the thesis examines the intimate connections between the design of the house, climate and attempts to engineer a permanent monocultural society.

Background

The late 19th century witnessed the emergence of a new metropolitan view that, with the right precautions, neither climate nor disease ought to restrict where Europeans could live in the world.6 Driven by the new science of parasitology and imperial expansion in Africa, its key proponents downplayed the effect of climate.7 Indeed, in the British Medical Journal in 1896, the Italian medical practitioner, Luigi Sambon, could proclaim acclimatisation to be “a mere question of hygiene”.8 Many seasoned observers, however, particularly those who had undertaken a tour of tropical service, remained convinced that Europeans would not undertake physical work in the tropics.9


6 Mark Harrison, Climates and Constitutions : Health, Race, Environment and British imperialism in India. (New Delhi, Oxford: Oxford University Press, 1999), 210.


9 Livingstone, ”Tropical Climate and Moral Hygiene: The Anatomy of a Victorian Debate,” 95-96. Livingstone highlights the general resistance among former colonial administrators to Sambon’s idea that a white labour force was possible in future African colonisation.
These attitudes were challenged by the construction of the Panama Canal by an American labour force and the development of Australia, including its tropics, as a ‘White Man’s Country’ at the turn of the 20th century. As Andrew Balfour, the medical director of the Wellcome Bureau of Scientific Research in London, told readers of the *Lancet* in 1923:

> Tropical Australia contains no less than 1,149,320 square miles and the development of this huge area depends on whether white men can live and work in it, not as they live and work in a country like India, but as tillers of the soil, as herdsmen, as labourers pursuing all these avocations which, as a rule, fall to the lot of the coloured races of the globe.\(^{10}\)

To metropolitan observers such as Balfour, the possibility that a European working class might flourish and stay in the tropics was a source of much disquiet. Far from European virility being considered unaffected by climate, Balfour feared degeneration—that in the tropics, Europeans could not maintain their elevated status above native peoples.

Two issues in particular framed the Queensland experience of the European inhabitation of the tropics: the thermal welfare of poor rural women and the transition from the lifestyle of a colonial overseer to that of an established settlement. In the process of addressing these issues by assessing and improving the conditions of white settlers, architecture and medicine were brought into contact to the extent that, by the end of the Second World War, architecture had come to normalise and systematise a physiological attitude to climate with the design of the post-war house.

Early 20th century medical publications on tropical hygiene form a valuable if little-explored resource for architectural history. This was a discourse largely driven by the establishment of schools of tropical medicine in Europe’s metropolitan capitals and port cities from 1898,\(^{11}\) American military interest in its new tropical possessions such as Cuba and Panama following the Spanish-American war of 1898,\(^{12}\) and research institutes, funded by

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11 The first specialist schools in tropical medicine were founded in Britain between 1898 and 1899 (Liverpool and London), with schools established in continental Europe in Hamburg (1901), Paris (1902), Lisbon (1902), Brussels (1906) and Marseille (1907). In addition research laboratories centred around the Pasteur Institute in Paris and Robert Koch’s Institute for Infectious diseases in Berlin took a strong interest in tropical diseases.

industrialists, such as the Wellcome Bureau of Scientific Research in London founded in 1913. The schools and institutes, like the London School of Tropical Medicine, with their concentration of experts and allied journals, such as the Journal of Tropical Medicine, acted as gatekeepers of ideas in the new field of tropical medicine. Doctors saw themselves as civilising missionaries in the tropics, saving Europeans and native alike, as Deborah Neill has noted. Through the virtues of modern medicine, they tried to extend their power to control disease into every facet of colonial life, from agriculture to public hygiene to the design of buildings. Publications from the 1890s to the 1930s, when interest in tropical hygiene died off, form a rich archive of such efforts.

While not every publication in this field includes information on building, many of the handbooks, annual reports and broader-ranging articles do. Such articles and books eased communication within a global network of medical experts so that local problems and design solutions often had a far larger effect than might be expected. For example, Breinl’s and Young’s article included a plan of a verandah-less house by local Townsville architect Charles Dalton Lynch. This would go on to be reprinted in the Indian Medical Journal and draw the attention of the Public Works Department of Calcutta. Although journals were one of the mechanisms used to unify the field of tropical medicine by creating a ‘common


14 Neill, Networks in Tropical Medicine, 59.


culture’ of shared knowledge that transcended national borders, it remains unclear how much access architects had to that knowledge.

Up to the advent of World War 2, designs for tropical housing rarely received any commentary within the architectural press in Britain, the U.S. or Australia, although there was some interest shown during the 1930s by European avant-garde publications. In 1931, Siegfried Giedion framed modern architecture’s southward advance in climatic rather than cultural terms, contrasting the technical struggle against cold in Northern countries (les pays du Nord) with the struggle against sunlight in countries of the South (les pays Meridionaux). Still, Giedion’s article was largely the exception and he seemed more interested in how modern architecture in warm countries might offer approaches to dealing with the European summer rather than in interrogating a condition of tropicality.

It would be another five years before a French architecture publication returned to the question of tropical housing and, while climate again was foregrounded, the solutions showed little innovation compared to medical publications such as Byam’s Practice of Medicine in the Tropics from at least a decade earlier. Therefore it seems likely that medical experts, with their access to international networks of information on building in the tropics, acted as mediators for local architects whose own professional journals mostly ignored such issues but who were well aware of the significance of this knowledge for the construction of new buildings in the tropics.

17 Neill, Networks in Tropical Medicine, 33-35, 58.

18 Some rare exceptions include articles by A.N. Rebori, "The Work of William E. Parsons in the Philippines," Architectural Record 41(1919): 305-324, 423-434; Sigfried Giedion, "L'Architecture contemporaine dans les pays méridionaux," Cahiers d'Art (1931), 103 Giedion, while celebrating the expansion of modern architecture to more southerly locations, demonstrates how fluid the conception of heat as a design problem was. Eileen Gray and Jean Badovici’s Villa E-1027 in Roquebrune France, Le Corbusier’s Villa Baizeau in Carthage, Tunisia and Gregori Warchavchik’s early Sao Paulo houses in Brazil were all placed together as dealing with similar climatic problems despite vastly different cultural, geographic and industrial contexts. It was really only in the second half of the 1930s that French publications started to address how architecture was being built in its overseas colonies. E. Weithas, "De La Construction en Pays Chaud," Architecture d'aujourd'hui 7, no. 3 (1936), 4-11.

19 Weithas, "De La Construction en Pays Chaud." 4-11.
Although medical experts were confident to debate and make pronouncements on the merits and failings of housing in the tropics and were using a variety of new metrics and instruments to judge building performance, they were still dependent on the available architectural and engineering expertise for construction knowledge and to provide plans of buildings. Indeed the design of buildings and towns in the tropics frequently came within the purview of civil and military engineers.20 Like doctors, architects and engineers could develop their expertise and spread their influence by moving through Britain’s imperial networks. The colonies provided metropolitan architects and engineers with the chance to experiment and test solutions to problems closer to home.21

Yet colonial service with its temporary postings and network of institutions such as public works departments, sanitary institutes and research institutes also provided opportunities for brief intersections between medical and architectural discourses on building in the tropics. For example, in 1908, the director of the Wellcome Tropical Research Laboratories at the Gordon Institute in Khartoum, Andrew Balfour, would turn to the Scottish civil engineer and lecturer at the Gordon Institute, W.H. McLean, for advice on tropical housing. McLean’s plans for tropical houses would illustrate a number of Balfour’s publications. Yet McLean’s advice on housing also drew heavily on the research of American Army doctor Charles Woodruff on the “Effects of Tropical Light on White Men”.22 It seems likely that McLean would have learnt of Woodruff's work through Balfour.23 This suggests both that such postings proved fortuitous for a two-way exchange between medical and

20 Scriver presents 19th century attitudes to architecture in the Indian Public Works Department as being dominated by military and civil engineers, with architects only exerting their influence in the early 20th century as Britain’s imperial ambitions shifted from the technical exploitation of the environment to the maintenance of social stability. Peter Scriver, “Imperial Progress: On the Impracticality of Problem-Solving in Colonial Indian Building,” Fabrications-JSAHANZ 11, no. 2 (2001).


building experts and that architects and engineers could tap into a cosmopolitan medical discourse and vice-versa.24

Experts in tropical medicine gained cosmopolitan expertise by studying at schools of tropical medicine and public health in Britain and in Europe’s imperial capitals and port cities and by undertaking colonial postings. The Australian public health administrator, J.S.C. Elkington, was typical in that regard. After studying medicine in Melbourne, in 1902 he gained a diploma in public health in London, specialising in tropical medicine and bacteriology. A stint with the Imperial Plague Research Laboratory in Bombay followed. He returned to Australia, where he commenced his career as a public health officer and, by 1921, had become head of the division of tropical hygiene in the Federal Department of Health.25

In contrast to medical experts, articled architects in settlement colonies such as Australia or Canada often had only limited overseas experience and this would most likely have involved only training or practice in Britain.26 Some architects working in the Australian tropics, most notably Mongolian-born Beni Burnett (1889-1955), traversed

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24 McLean also had an international outlook, presenting his work on Khartoum to the 1910 RIBA Town Planning Conference. His later career would include postings in Egypt (1913-26) and Palestine (1918). For an overview of his career see Robert Home, "British Colonial Planning in the Middle East: The Work of W.H. McLean," *Bulletin of the Planning History Group* 12, no. 1 (1990), 4-9.


through imperial networks but they were the exception rather than the rule. 27 In early 20th century Queensland most, like Breinl’s and Young’s architect in Townsville, Charles Dalton Lynch, seemed content to gain an apprenticeship with a nearby firm. Many, however, travelled across and between states in search of opportunities from gold rushes, improved agricultural production or to escape economic downturns, as Lynch later did. In the process they gained considerable knowledge of local practices across the state but it is doubtful that they were otherwise aware of international practices of architecture in the tropics. This suggests an interesting exchange between local architects, who understood the available methods and means of constructing buildings, and cosmopolitan doctors who acted as cultural agents.

Tropical Architecture and Forms of Colonial Expansion

While the links between tropical architecture and colonial and post-colonial culture have been the source of much study, we should not assume that this colonial culture was uniform or that every colony developed along similar lines. 28 Indeed, it is important to consider the type of colony in which a building is located. Understanding this taxonomy of colonial forms allows us to see what types of building were most crucial to the colonial or decolonising project.

The distinction between tropical settlers, tropical migrants and tropical sojourners is of central importance to the thesis. Tropical sojourners, such as missionaries, doctors, army


officers, engineers and architects, undertook a term of service in imperial outposts whereas, as Patrick Wolfe notes:

settler-colonists went to stay. In the main they did not send their children back to British schools or retire 'home' before old age could spoil the illusion of their superhumanity. National independence did not entail their departure. Tropical migrants were distinguished from settlers and sojourners by questions of sovereignty and difference. Settlers and sojourners brought their sovereignty with them, whereas migrants had to fit into a pre-existing settler vision. As James Belich has highlighted, “an emigrant joined someone else’s society, a settler or colonist remade his own”. Settlers, therefore, sought to create a homogenous society of people they viewed as similar to themselves and struggled to accommodate migrants who were defined by the settler body not by their similarity but by their difference. In White Australia, settlers identified particular values such as fair wages, hard work and good hygiene as characteristic of the society and, as we shall see in Chapter 2, presented migrants such as Pacific Islanders as a threat to these values.

Settler colonisation was more a question of demographics, land improvement and the reproduction of the settler body than the temporary protection and distraction of a colonial elite. Compared to colonies of exploitation, settler colonisation prioritised the appropriation of indigenous land over the appropriation of indigenous labour. Hiding behind the doctrine of *terra nullius*, European colonists argued that land could be converted into property if it were improved; with such improvement came rights to unrestricted use. Conversely, land that was seen to support a population inefficiently could be claimed by those societies who could

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better exploit it. Construction was closely aligned with land improvement since the fencing in of land and the building of structures were among the tests of improvement. In settler colonies, architecture was not simply about shelter but was also a legal tool of land appropriation.

Most recent case studies of tropical architecture have been located in what Osterhammel classifies as either exploitation colonies or maritime enclaves. Exploitation colonies, such as British India, involved military rule with relatively few colonisers, whose object was to gain tax revenue, trade monopolies and imperial prestige. Maritime enclaves, like Singapore or Batavia, similarly sought trade monopolies but were a means to exert informal control over a regional hinterland through naval backing. Consequently barracks buildings in India, the expansion of hygienic enclaves to native Singaporeans or (into the 20th century) the symbolism and segregation attached to Lutyens’s Delhi or Le Corbusier’s Chandigarh have all been subjects of analysis.

Enclaves by definition were urban, whereas settlement colonies, with their interest in land exploitation, initially were rural. The expansion of settler colonies, and the internal colonisation that often went with it, focused on the resumption of land for agricultural and mining purposes. Settlements centred on the production of commodities such as tobacco, coffee and sugar feature prominently, as do those associated with gold rushes and diamond mines that attracted settlers and migrants from across the world.

Yet settler colonies were not homogenous in form but varied depending on the relationship and proportion of settlers, migrants and indigenous peoples. Osterhammel distinguishes three key geographical types: New England, African and Caribbean settler colonies. New England colonies like Australia, which were denied the value of an indigenous workforce, sought to exploit indigenous land rather than labour. Much recent scholarship has been characterised by the study of frontier settlements, suburbia and mass housing along with a belated investigation into long-denied indigenous architectural

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33 Wolfe, Settler Colonialism and the Transformation of Anthropology, 26.


35 Osterhammel, Colonialism: 6-8.
Settlers tended to be few in number in African and Caribbean settler colonies and heavily reliant on either an indigenous workforce (in the African case) or imported slaves (in the Caribbean).

The expression of distinctions among settlers and indigenous peoples through architecture has been a key question for architectural historians who have investigated African settler colonies like Algeria or South Africa. Studies of tropical architecture in Caribbean settler colonies have focused on the early design of barracks and on how mid-20th century British paternalism sought to use architecture and institution-building to quell anti-imperial resistance. Although there are many parallels between exploitation colonies and settler colonies of the African and Caribbean type, insofar as in each case a small minority sought to dominate and control the lives of the vast majority of inhabitants, the question of how architecture was used as a tool of settlement requires further study. For example, we know little about the spaces that settlers, slaves or indigenous people encountered across their lifetimes, since the emphasis has been on the spaces of a working population. Further work is also required to explore the spaces in which settler societies sought to reproduce themselves, not only publicly but in the home—what Ann Laura Stoler calls “the intimate frontiers of empire”. This dissertation contributes to that project.

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37 The decolonisation of American plantation economies is more complicated. Although the Civil War put an end to slavery, indigenous autonomy is still largely absent.

The Tropics as a Temperate Other

The tropics themselves have been represented as both spaces of abundance and as ‘the white man’s grave’. By the end of the 19th century, Britain, France, Germany, Belgium, Netherlands, Portugal, Spain, the United States and Germany all had colonies in the tropics but Britain—with colonies in Africa, the Caribbean, South America, India and South East Asia—was by far the largest imperial power. Tropical produce and people were widely represented as a source of European profit, but Britain’s colonial expansion in the 19th century came with questions about whether the economic benefits were worth the medical risks to Britons living in tropical countries. As Europeans increasingly subscribed to modern ideas of self, distinctions based on race, class and gender became more entrenched. Europeans began to self-identify in terms of race as well as gender and class and became increasingly anxious that colonial service would lead to emasculation and racial degeneration. Demographic control and, with it, the control of fertility became a source of much national and colonial anxiety.

As Mark Harrison notes, “the making of race mirrored the making of sex, in that it was only at the very end of the eighteenth century that writers began to insist that there were fundamental, biological differences between men and women”. Britons no longer believed, as they had during the 18th century, that their character was shaped by lifestyle, diet and physical environment; rather, it was solely a question of heredity. This idea of inherited difference helped to naturalise existing positions of power through its claim that political behaviour, gender identities and distinctions between civilisations were determined by race, class and sex. For much of the 19th century, environment was no longer seen to determine a person’s character (as it had done since the time of Hippocrates); rather, heredity meant that

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41 Harrison, *Climates and Constitutions*, 12.

42 Harrison, *Climates and Constitutions*, 11-17.

individuals were most suited to particular environments. With the 19th century racial turn, Britons in India, for example, were seen to be out of place, and the best that could be hoped for was to locate military and administrative settlements where the weather was as close as possible to that of home.

By the end of the 19th century, however, such rigid views about the roles that different classes and genders could play in society were starting to be challenged by the rise of communism and the suffragette movement. Yet while working class men claimed greater political rights, those in Australia and the Pacific North-West started to exercise these rights to exclude those of other races. In the process they challenged a century of beliefs that there were climatic limits to European settlement and that race per se did not dictate the environment in which one had to live. Instead, Europeans were free to live anywhere, regardless of climate. Yet for those who were not born with European heritage, politics, not climate, would continue to dictate the environment in which one could live until well after the Second World War.

While communists and suffragettes in the cities of 19th century Britain and Europe worked collectively to improve the welfare and rights of working men and women, in settler societies such as Australia similar arguments for workers’ and women’s rights were racialised and set against a fear of loss of settler sovereignty. During the late 19th century, “in both Australia and the United States,” as Henry Reynolds and Marilyn Lake have noted, “working class identities were constituted in a discourse of racial difference that defined the white worker as the bearer of civilisation and its responsibilities”.

Tropical medicine’s emergence at the end of the 19th century not only reinforced ideas of tropical difference, but also reinforced fears that, while heredity might determine susceptibility to disease in temperate parts of the world, climate and environment still mattered in the tropics. At the turn of the 20th century, the prevailing belief that the tropics were unsuitable for long-term European residence had already been challenged by publicity about the successes of Australian settlement in Queensland and the experience of Americans


45 Harrison, Climates and Constitutions, 60.
working on the Panama Canal. Indeed, the tropics in Australia were refashioned in the early 20th century by doctors and politicians, not just as a space apart, but as an incubator for new forms of white identity, set against a background of territorial struggle between white Australians, Pacific Islander migrants and an ascendant Japan with imperial ambitions. Yet questions remained about the intergenerational effects of tropical residence on the productivity and reproductivity of settlers.

According to the medical historian, David Arnold, tropical difference is as much an intellectual as a physical construct. Arnold has noted that the tropics have long been presented as Europe’s environmental ‘other’, in a similar fashion to Edward Said’s (framing) analysis of the West’s systematic representation of the Orient as its cultural other. Ideas and attitudes of environmental difference—what Arnold terms ‘tropicality’—shaped (and continues to influence) European understanding of medicine, culture, race, labour and agriculture in the tropics. These differences have constantly been measured and imagined against temperate norms. Yet with architecture, as with medicine and agriculture, such norms are assumed. There is no ‘temperate architecture’, ‘temperate medicine’ or temperate agriculture’, although there is tropical architecture, tropical medicine and tropical agriculture. Architecture in temperate areas is defined by nation, region, epoch or style. In contrast architecture in the tropics has been defined more by environmental attitudes than by regionalism, nationalism or style.

Anthony King and Jiat-Hwee Chang define tropical architecture as “a set of shifting socio-cultural and technoscientific discourses that privilege tropical ‘nature’, especially

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46 Anderson, The Cultivation of Whiteness, 76.


49 King has noted the nationalism associated with the Arts and Crafts movement was as dependent on inter-state rivalry for definition as any understanding of local tradition. Anthony D. King, Spaces of Global Cultures: Architecture Urbanism Identity (London: Routledge, 2004), 162.
climate, as the prime determinant of built form”. This privileging of the environment in tropical architecture enables us to explore how climatic performance was used to filter the translation of regional, national and stylistic approaches to architecture from other locations. In doing so, it also allows us to consider how the power ascribed to the environment in the tropics could be both a means of control and a tool of resistance, a means of putting settlement on a rational basis (as I argue in Chapter 2) or an argument for rural women to improve their spatial conditions (as I discuss in Chapter 3).

Architectural historians, with a few notable exceptions, have tended to shy away from theorising the changing relationship between climate and society, or between climate and architecture. The meaning of climate for architecture tends to be seen as something that is fixed. Changing expectations of how buildings and climate interact have related more to changes in technology or architectural ideas than to any shifting valuation of climate itself. Yet, as the geographical historian William B Meyer has argued in relation to climate’s more immediate cousin, weather:

Generally speaking, weather matters to people in two ways: as a help and a hindrance, as a resource and a hazard, as an opportunity and a constraint, as a source of gains and a source of losses. To what extent and in what ways it plays either role depend on the activities and wants with which it interacts.

In other words, as society’s requirements and activities change, so too does its valuation of climate and weather (as climate experienced).

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51 Chang and Barber are perhaps the main exceptions. Theorists such as Luis Fernández-Galiano and David Gissen have touched on historical issues surrounding the relationship between architecture and thermal environments, yet the thrust has been more about how architects sought to make climate irrelevant than alternative valuations of climate through time. See David Gissen, "Thermopolis," Journal of Architectural Education 60, no. 1 (2006); Luis Fernández-Galiano, Fire and Memory: On Architecture And Memory (Cambridge, Mass.: MIT Press, 2000).


Rather than viewing architecture’s relationship to climate in purely functional terms, this thesis explores architecture as a mediator of climate’s importance to society. If people value weather depending on the activity they wish to carry out, then buildings, with their weather-dependent technologies, can alter the significance of their actions. Buildings can make the climate appear more threatening, for example by trapping hot air when it is unwanted or failing to protect against strong winds. Buildings can disrupt racialised or gendered activities such as cooking, cleaning and childminding, making particular climates appear unsuitable for men, women or particular ethnic groups (see Chapter 3).

At the same time, buildings themselves need not change to alter their mediating role between climate and society. Replacing one activity with another is as likely to alter the impact of weather as any change of technology or even change in the weather itself. By bringing objects and people together, by sheltering activities and by making climatic conditions appear more or less important, buildings play a social role. In fact, buildings and their technologies, as actors in a web of social ties, not only carry meaning but can also transform it. A house, as we shall see, is not just a shelter for family life, but a tool of settlement, an indicator of whether tropical acclimatisation was considered viable. As the sociologist, Bruno Latour, notes: “mediators transform, translate, distort and modify the meaning or the elements they are supposed to carry.” 54 It is this distortion of meaning about climate by the norms, activities and technologies associated with buildings that I wish to explore in this thesis.

The Intimate Frontiers of Empire

Colonial relations were tested and reformed as much in the home as they were in public. Systems of segregation and hygienic practices for the tropics were comprehensively investigated in India, for instance, with the development of the cantonment system for military barracks in the 1870s and 1880s. 55 During the 19th and early 20th centuries, colonial

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officials, particularly sanitary reformers, treated standards of hygiene as evidence of standards of civilisation. Nowhere was this considered more important than in the home. The home as a site for washing, eating, defecating, procreating and giving birth was viewed by sanitary reformers as both the locus of disease and a place in which to inculcate good living practices. In part this stemmed from three interrelated beliefs: that white bodies were out of place in tropical environments; that common British domestic practices and technologies were insufficient to protect Europeans in the tropics; and that good hygiene expressed elevated status, representing an aristocratic marker and a way of screening people’s animal instincts. In effect, maintenance of good hygiene was an expression of the right to rule.

From the mid-19th century, these beliefs came to implicate non-European bodies as well. Whereas indigenous bodies and technologies were considered natural to their environment, indigenous hygiene standards were regarded as evidence of ignorance, a threat to the well-being and longevity of European residents and, towards the beginning of the 20th century, the cause of low labour productivity. In the Subcontinent, where Europeans and Indians had lived side by side up to the middle of the 19th century, sanitary and defensive arguments were used to justify racial segregation of European and Indian communities in Madras, Bombay and Bengal from 1864. Claims of disease prevention as a pretext for racial segregation were not confined to British rule in India. Curtin and Home argue that similar scenarios prevailed in a number of colonial cities across Africa—from Freetown, Sierra Leone to Mombasa, Kenya—between the 1880s and 1930s. The success of modern sanitary measures helped elevate tropical medicine’s status such that, by the turn of the 20th century,


57 Chang and King, "Towards a Genealogy of Tropical Architecture":283-300.


city design and building design in the tropics were as much matters of medicine as they were matters of architecture.  

Yet the design and functioning of the home in exploitation colonies introduced a paradox. Although indigenous people were considered a threat to health, Europeans did not cease to be reliant on them. Europeans still expressed their colonial status through the grandeur of their architecture and the exploitation of indigenous labour that came with it. As Benedict Anderson notes:

In each colony one found this grimly amusing tableau vivant: the bourgeois gentilhomme speaking poetry against a backdrop of spacious mansions and gardens filled with mimosa and bougainvillea, and a large supporting cast of houseboys, grooms, gardeners, cooks, amahs, maids, washerwomen, and above all horses.  

Although servant and served spaces were segregated in colonial homes—for example, servant outhouses were typically located downwind of the main residence in an Anglo-Indian compound—the colonial home was a place where European and indigenous people interacted on a daily basis. Yet while people of different backgrounds might mix, colonial power differences were both negotiated and reinforced in the kitchens, bedrooms and living rooms of the home. Therefore it was in the home, as much as in the street, that racial differences were acted out, monitored and resisted.

From the late 18th century on, as Mark Harrison has explained, Europeans began to imitate aristocratic standards of hygiene to express and maintain their own social distinction. Those with lower hygiene standards were considered of lower status and this reinforced


63 Stoler, "Tense and Tender Ties," 832.
distinctions between coloniser and colonised. The diminished status of indigenous people was, by extension, naturalised by colonial officials drawing attention to differences in hygienic practices. Writing in 1905, G.M. Giles, a retired officer of the Indian Medical service, advised would-be colonial families that:

[...] most English Housekeepers will probably admit that, even with a home establishment, a certain amount of superintendence of below-stairs can hardly be dispensed with; and if this be so, how very much more must such scrutiny be necessary in places where the workers belong to races to whom cleanliness in such matters is an exotic curiosity.

Yet the colonial status of Europeans was also played out in many tropical territories via the employment of indigenous labourers to carry out the mundane and menial tasks of household work. Therefore it was in the tropical house that the management of contact between indigenous and European people became increasingly viewed as a matter of public health.

In Australia, away from the interior, this was considered less of an issue. Although Aboriginal women and non-Europeans were more likely than the rest of the population to work as domestic servants, for demographic reasons they made up a small proportion of the total number of servants, who were predominantly categorised as ‘white’. At the turn of the 20th century, when servant-keeping was at its height in Australia, less than 10% of households in either New South Wales or Queensland employed servants. The fact that few tropical settlers employed servants created a significant distinction between the British image of the White tropical home as a site of leisure and service and the reality of settler life in northern Queensland. The reconfiguration of the layout of overseas prototypes of tropical architecture for servant-less living was of considerable interest to the medical profession and a number of local architects.

Accordingly there was a two-fold challenge in servant-less living in tropical Australia. On the one hand, white racial superiority was played out through discourses of cleanliness

64 Harrison, *Climates and Constitutions*, 21-22.
65 Harrison, *Climates and Constitutions*, 21-22.
68 Higman, *Domestic Service in Australia*, 45-46.
and the expectation of service. Yet in northern Queensland, as through much of Australia, the availability of servants greatly declined during the early 20th century, with much of the blame attributed to immigration restriction. This in turn was seen to make the settlement of the north of Australia unattractive to white families. At the turn of the century and in the 1930s, governments did toy with the idea of increasing the population of northern Australia by importing non-Europeans. However this was curtailed by the belief that an ethnically homogenous population was in the best interests of the country. Europeans living without servants in Northern Australia challenged what had become accepted norms of White lifestyles in other parts of the tropics. I argue that the ‘tropical servant-less house’—a product and index of historical circumstance—became the focus of considerable anxiety among public health officials and women’s groups at the turn of the 20th century.

Living without servants introduced new rhetorics of productivity and reproductivity into the home. Far from being a private sphere, the home and its occupants were the objects of considerable scrutiny. The problem of servant-less living was viewed as both a political problem that needed to be managed and as an opportunity for citizenship. This biopolitics of the tropical home in northern Queensland differed from that of its counterparts in Britain and colonial entities such as Singapore in a number of significant ways.

Servant-less living came to be viewed by reformers as an expression of white independence. While sympathetic to the hardships faced by settler families, doctors like Raphael Cilento considered physical labour as a key of settler community. Community groups concerned with the health and welfare of rural women found ways of offering respite from the climatic conditions of northern Queensland and their effects on the domestic abode. For instance, they supported a holiday program to give women a break from an inhospitable home. Neither experts nor community groups, however, were able to enact widespread reform of the tropical house itself during the interwar period.

With limited public research infrastructure at this time, attempts at field investigations were limited to small, privately funded studies into the effect of climate on the internal temperature of different classes of housing; laboratory research into building materials or

modes of assembly was similarly limited. Most reformers placed their faith in competitions for model homes as a way of educating both the architectural profession and the general public. It did not matter whether the competition was to attract a national or regional set of entrants, nor would previous failed attempts at organising competitions dampen the enthusiasm of organisers. Rather, it appears that competitions allowed architects to address issues of broader value to Queensland. Organisers believed that the best results would come from having a wide number of entries. For organisers, the fact that there were so few architectural competitions in Queensland during the 1920s (the main one being for the ANZAC War Memorial in Brisbane from 1921) only added to their appeal.

Between 1921 and 1930 there were two main attempts to organise housing competitions. The first was a collaboration (from 1921 to 1923) between the Governor, the Brisbane Women’s Club and the Public Health Association. It sought to attract the best practitioners in the country and to brief entrants on the latest housing innovations in other tropical locations. The second, in 1930, was a more modest affair, centred on housing problems for Western Queensland. It was the outcome of a long-standing effort, since 1925, by members of the Queensland Town Planning Association to mobilise Queensland architects to offer solutions to regional housing problems. Yet organisers, who tended to be middle-class professionals rather than business people, struggled to find the requisite funding for such competitions; consequently, those that were held, had limited impact.

There were, arguably, limited incentives for either the architectural or medical profession to reform the design of the house at this time. For the architectural profession, this stemmed in part from the lack of architects in northern Queensland and in part from the strictures of the Workers Dwelling Act as implemented from 1909. In 1923, there were 43 firms of architects in Queensland, but only nine firms were located in the tropics; of these, most were sole practitioners.70 Consequently few houses in northern Queensland were designed by architects. Indeed a report that year on building conditions in Townsville claimed that “not one in fifty houses is built to an architect’s design or supervision.”71

70 As reported in the Architectural and Building Journal of Queensland (ABJQ), 2, no. 16 (September 1923).
71 “Building Conditions in Townsville,” ABJQ 1, no. 12 (1923),
From 1909, many houses were instead built to standard designs provided by the State Advances Corporation. The Corporation was set up in 1909 to implement the Workers Dwelling Act through the provision of finance, building contracts and plans. From 1909 to 1939, it enabled 17% of Queenslanders to become homeowners and saw the construction of over 21,000 dwellings. However the plans provided by the Corporation had to be easily constructed by any builder in the state. Consequently they took no account of regional differences in construction methods or climate and made little allowance for any construction innovation. In addition, private architects could not draw up plans under the scheme until 1935, and then only for the more expensive houses. Therefore public architects in the State Advances Corporation had to produce conservative designs for a conservative building industry while private architects were excluded from exerting any influence on the design of workers’ homes.

Workers’ housing was considered a form of public works so private architects were barred from tendering their services until 1935. The architectural profession itself was split between those in government employment and those in private practice; the latter, and their representative body, the Queensland Institute of Architects (QIA), were particularly resentful of the lack of opportunities to undertake public buildings. Accordingly, if tropical medicine were to influence architects in the design of workers’ homes, it would have to be via government architects. While there is some evidence that doctors did review the design of tropical housing by the Public Works Department (PWD), as I show in Chapter 3, this seems to have had limited influence.

Arguably, due to their interest in tropical hygiene and networks across the tropical world, practitioners of tropical medicine had greater knowledge and access to information on innovations in tropical housing than architects did. During the 1920s, however, doctors appeared more interested in proving that, despite the heat and humidity of the coastal tropics, Europeans could live healthy (if not comfortable) lives. With few architects practising in the tropics and few clients employing them, medical publications could have only limited impact.

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on tropical housing by influencing private architects. The architectural profession instead preferred to use style to confer status, even if that compromised performance, and showed little of the concern for the improvement of workers’ living conditions that its European counterparts did at that time. Nor could doctors make much impact on the design direction of workers’ homes in public works departments towards greater climatic specificity. Economic rationalism trumped climatic rationalism; in broad terms, housing had to be buildable across the state at a low price, whatever the climate.

It was only in the area of town planning that medical and architectural interests converged and were given an equal public platform. Yet, although doctors did advise on the siting and layout of towns near Brisbane, there was general silence during the 1920s about urban development in northern Queensland. From the turn of the century through to the early 1930s, the vision for the development of Northern Australia was based on agriculture and mining, not manufacturing. Consequently there was little discussion about the design of tropical towns. Instead the rural house and farm were considered the key to the long-term settlement of the state.

Nonetheless both architects and doctors persisted in claiming that they could reform the tropical house. I argue that, although both professions had little interest in improving housing conditions for tropical settlers as such, the reform of the tropical house was a useful political tool to show that each profession’s interests were aligned with those of the nation and the state: architects claimed that they alone were competent to improve housing conditions across the state and medical professionals argued that their research was vital to understanding and managing the physical stress of tropical life.  

Architects in Queensland used the spectre of the tropical house to push for registration during the 1920s by claiming that poor housing was due to unscrupulous building practices and that registration was the best way to protect the public. Yet when, in 1919 and in 1925, prominent architects in the Queensland Town Planning Association did address the question


of the design of the tropical house, women’s groups and self-appointed experts on tropical housing ridiculed their efforts as impractical and ignorant of living conditions. Instead, with registration assured in 1928, architects argued that a state university course was required to improve the design standards of architects in Queensland, particularly those in Brisbane. Far from Brisbane architects showing they knew how to design across the state, design competitions for tropical housing revealed a lack of regional knowledge and a need for further education of the profession.

Despite the apparent inability of both architects and doctors to reform the tropical house during the inter-war period, I argue that competitions and the Queensland Town Planning Association provided venues for the translation of a medical discourse on the tropical house into architecture.

Although knowledge about the control and assessment of tropical environments was shared between metropolitan centres and colonies throughout the tropical world, tropical architecture in white settler communities such as Queensland was a distinct formation, owing more to metropolitan debates about workers’ health and safety in hot industries than questions of disease control or segregation. Tropical architecture in exploitation colonies was concerned with the short-term health and welfare of colonial officers in urban or plantation settings or the long-term health (but not welfare) of colonial subjects.

Tropical architecture in settler Queensland differed in three key ways. First, tropical architecture was assumed to be un-serviced, being independent of indigenous or non-white migrant labour. Secondly, tropical architecture in Queensland had a distinctive subject, the White, servant-less, rural housewife, whose welfare was assumed to be the main harbinger of the likely success or failure of future settlement. Thirdly, the provision of thermal relief was considered as much an act of citizenship as a medical or industrial necessity, with women’s organisations and public health organisations in particular taking an interest in the thermal welfare of rural housewives. Finally, as the Second World War drew to a close, what had been a medical discourse on climate and the tropical house in Queensland became an architectural discourse around all warm climates in Australia.
Organisation of the Thesis

Chapter 1 explores early 20\textsuperscript{th} century medical discourse on the tropical house in a range of colonial and non-colonial contexts. The chapter examines the continuities and discontinuities in how environmental technologies and planning were validated by doctors when used in different types of colony. Technologies used to prevent insect-borne disease frequently caused overheating of internal spaces. Whereas doctors had little regard for the overheating of labourers’ dwellings in Malaya, it was of great concern in Tropical Queensland. Although the control of tropical disease in homes was seen to be a problem across the tropical world, I argue that the different kinds of power and race relations found in different types of colony altered the way in which particular technologies, such as mosquito screens, were applied. It also created different rationales for whether the thermal comfort of occupants was considered a priority.

The chapter examines designs published in tropical medicine text books, reports and journals for ‘mosquito-proof housing’ for sites in Italy, Panama, India and Malaya and ‘tropical houses’ for sites in Sudan, West Africa and Australia. While medical text books and journals helped to spread ideas on housing across vast distances and to create an international discourse on the tropical house, I contend that, in practice, regional differences had as much to do with political and personal factors as climatic conditions or metropolitan debates in medicine. The chapter proposes that, different types of colonial formation influenced a variety of approaches to how the hygiene and comfort of occupants were controlled by sanctioning or minimizing colonial and indigenous interactions while, at the personal level, doctors’ travels affected their preference for particular ways of constructing and organising buildings. These aspects tended, in turn, to decisively shape the building cultures where these individuals took a role in colonisation or settlement.

The settler housewife—unlike her middle class counterparts in Britain or colonial counterparts in Africa and Asia—was herself considered a domestic worker, not a manager of domestic servants. The distinctive racial demographics of northern Queensland, where whites laboured both in the field and at home, was much noted in medical and political circles at the turn of the century. Although servant-less living was also raised as a new problem in Britain, White women undertaking physical work in a hot climate challenged assumptions about racial status, productivity and reproductivity in the tropics. Therefore the second difference was that the tropical house in Queensland was not seen as a place of colonial leisure, but was
recast as a domestic workplace, with the kitchen (which was in turn scrutinised as an industrial environment) a miniature form of hot industry. Women were held to the same thermal standards as their male counterparts working in mines and factories in industrial Britain. While such standards helped to determine for how long and in what temperatures people could safely work, in Australia they also helped to determine the places that were safe for settlement.

The control of temperature was considered by experts to be one of the main means of shaping society and behaviour in the tropics. Temperature was concurrently spatialised at both a continental scale in northern Australia and at the intimate scale of the house. Equal lines of temperature, known as isotherms, denoted thresholds. We can think of them as ‘thermal frontiers’, which were seen by many as needing to be tamed through technology in order to mitigate supposedly harmful effects. Limits were set for European populations based on the adaptability of the population and whether or not it comprised of settlers specially selected for the climate. Consequently new ways of assessing temperature had profound effects on what activities experts thought were possible in any given thermal zone and the role the house might play in enhancing or impeding politically desirable outcomes.

Chapter 2 pursues this theme, focusing on the development of thermal standards for northern Queensland in particular and on the way in which the house was consequently


77 The house was considered a corrective device when average temperatures were close to an acceptable upper threshold. The fear was that beyond certain temperature limits only a select group of men and women could maintain their work ethic, whether in the field or at home, putting at risk the project of white settlement. For example in 1921, the Melbourne academic and former Nationals politician, Sir James Barrett, gave his guarded support in the Medical Journal of Australia to a suggestion by Dr. Clifford Tucker for white people to develop the highland areas of Eastern Queensland, “provided that the housing conditions are of such a character that women can work without being exposed to a high wet-bulb temperature”. Barrett, who was a frequent commentator both in Australia and Britain on white settlement in Tropical Australia, then outlined his attempts to convince the Commonwealth Government to adopt similar housing to that found in Panama. In his short letter, he also backed up his support of Tucker by going into detail about the merits of the wet-bulb temperature as a determinant of whether there were any obstacles “to the development of a vigorous white race”. James W. Barrett, "Tropical Australia," Medical Journal of Australia (1921), 73.
positioned in political debate. I explore how standards for hot industries in Britain came to be developed and translated into a tool of settlement in Northern Queensland. Although climate’s influence on health was downplayed by experts in tropical medicine, I suggest that the regulation of work in hot industries in Britain in the early 20th century opened up new questions about safe thermal limits for productive physical work. Questions about whether Europeans could undertake physical labour in the tropics were brought to the fore from 1901, when Acts of Parliament severely restricted the immigration of non-Europeans and allowed for Pacific Islanders working in Australia to be rounded up and deported. At the outset of Australia’s federation, the Immigration Restriction Act (1901) and the Pacific Islands Labourers Act (1901) together defined what was commonly described as ‘the White Australia Policy’. The chapter looks at how, in northern Queensland, limits imposed by this policy came to be both racialised and gendered, impacting on debates about where was safe for settlement and how people ought to live. Using newspaper, medical and climatological reports and maps, I show how new indices reinforced a medical view of the tropics as a thermal frontier and brought attention to community fears that the indoor climate of dwellings was worse than the outdoor climate in the field. As such, doctors came to evaluate housework in the tropics as a domestic hot industry and to identify the settler housewife and the design of the kitchen as key subjects for study.

The provision of thermal relief was considered as much an act of citizenship as a medical or industrial necessity, with women’s organisations and public health organisations in particular taking an interest in the thermal welfare of rural housewives. Chapter 3 thus examines the community response to the plight of the ‘Women of the West’ and attempts by architects, women’s groups, town planning associations and public health associations to find new solutions to tropical living. I compare two key vehicles—the seaside homes movement and design competitions for tropical houses—in terms of how they brought medical discourse on the tropical house into the purview of architecture and how the problem of tropical living was able to engage the community to varying degrees.

Using newspaper reports and records from the Queensland Country Women’s Association (QCWA) and State level architectural journal reports, I trace the engagement of doctors, countrywomen and architects during the 1920s in Queensland. Ultimately I argue that while women’s organisations developed practical methods to help countrywomen cope with the isolation and climate of rural northern Queensland, neither architects nor doctors
managed to enact widespread reform of the design of the tropical house. I posit that both
doctors and architects had few incentives to reform the tropical house itself, but both used
community anxiety about the welfare of tropical families to argue for greater political support
for their profession and its education. At the same time, the early tentative efforts of civil
society groups to bring medical and architectural experts together helped normalise a medical
discourse on the tropical house within the architectural profession in Queensland.

The Second World War re-opened questions about the vulnerability of tropical
Australia to foreign invasion and the effects of a warm climate on fatigue and human
efficiency. However it was only with the prospect of planning for peace that the tropical
house for settler Australia received renewed attention and formal collaboration between
doctors and architects was instituted. Post-war planning allowed experts to project fantasies
about what the house of the future would be. For doctors, it was the chance to develop
housing and cities along physiological lines, while for architects, dreams of the house as a
mass-produced object appeared within reach. Both doctors and architects sought to carry over
the lessons of war-time design and construction to benefit the civilian population. At the heart
of the matter was a shared belief that house design could be rationalised and that, like the
war, could be centrally planned.

Although doctors and architects agreed that housing ought to be rationalised, post-war
housing design and town planning revived the question of whether the performance of the
building in use or greater economy in its construction should be prioritised. Whereas doctors
held out hope that the tropical house’s thermal performance would be made predictable,
controllable and regulated to minimise its inhabitants’ discomfort, the exigencies of war-time
shortages of labour and materials saw thermal indices put to other uses. Instead of being
deployed towards what one physiologist hopefully termed “thermal welfare”, these indices
were instead used to enable cost-cutting in building construction. The tropical house was not
to be improved, but merely maintained at a tolerable level of discomfort. Architects sought to
set minimum standards of thermal performance to assess how they could produce houses with
at least tolerable levels of discomfort using less materials and labour. Despite this, both

(Brisbane: University of Queensland, 1947).
architects and physiologists considered that climate, not tradition or availability of material or labour, would determine any regional differences in building design.

Chapter 4 examines how the problem of post-war planning helped to catalyse efforts to reform design and research on the tropical house, reframing the tropical house from a medical problem into one of construction economics. The chapter explores tensions between the medical view of the house as a third skin and the quest to improve the thermal performance of dwellings against the economic challenge of meeting pent-up demand for housing in the face of material, labour and housing shortages. I claim that the war brought architects and medical experts together again with renewed purpose and provided the foundation for an architectural discourse on the tropical and sub-tropical house in Queensland. At the same time, although many of the earlier tropes on climate, settlement and domesticity were brought to the fore once more, I suggest that the material context of the war shifted questions away from how to improve the standard of comfort of tropical housing to how to maintain existing standards despite labour and material shortages. Architects’ appreciation of the ability of the scientific method to deal with questions of scale also helped lay the foundation for what came to be known as the bioclimatic approach to architecture.

In the process, architects turned to physiologists to help standardise the thermal assessment of buildings, thus normalising a physiological discourse on temperature and codifying climatic design not just for the tropics but for the whole of Australia. Whereas at the turn of the century the thermal effects of house construction in the tropics was a topic of national concern, by the end of the Second World War the overheating of homes had become de-tropicalised, codified and recognised as an issue for much of the continent.

Yet, I contend, the division of labour for research into climatic design for all of Australia carried colonial overtones forward into Australia’s first decades as a modern nation. Australia remained reliant on Britain for environmental standards for cold climate design, but developed its own systems to research the thermal performance of dwellings in warm climates. While this helped to develop an independent tradition of building research in Australia, it was also an attempt by Australia to maintain a position of leadership within the Commonwealth of Nations (founded in 1949) in the post-war era of decolonisation. The outputs and key people would come to influence research on climatic design in the USA, India, Israel and South Africa as well as UN Missions on so-called Third World development. Therefore what started with a regional problem of settler comfort, developed into a set of
guiding documents and standards for post-war housing throughout much of the tropical world.
In today’s world of environmental design, where building performance simulation is essentially a branch of building physics, it can be tempting to view the history of architecture’s relationship with the environment solely in terms of the changing valuation of climate and physical comfort.¹ Judging by the range of histories that have followed the path of Reyner Banham’s seminal Architecture of the Well Tempered Environment in 1969,² modern architecture’s environmental concerns are largely thermal. This ‘thermal modernity’ can highlight the role played by technologies such as air conditioning, shading design and mechanical heating in nation-building, economic development and urbanisation.³ Yet it also risks reducing both environmental design and climate to social, political and technical questions that arise from issues around temperature control.

Environmental design can cover a much broader interpretation of external conditions than those associated with temperature regulation. In the guise of Ecological Design, it encompasses the regulation of material and energy flows or, in the words of Sim Van der Ryn and Stuart Cowan, “any form of design that minimizes environmentally destructive impacts by integrating itself with living processes”.⁴ While this definition seeks to expand designers’ understanding of their responsibilities, it points to both an aim and a method for designers to


The ambition to minimise environmental destruction forms part of an apocalyptic tradition of environmental architecture in which interventions, from garden cities to low-carbon technologies, are understood as necessary to mitigate the cataclysmic effects of industrialisation.

This is not to say that bioclimatic architecture is the only form of environmental architecture today. The all-too-neat professional division between architecture and landscape architecture has broken down with the advent of landscape urbanism, revitalising discussion of the relationship between buildings and natural habitats. Many municipal services, in particular sewerage and refuse collection, have been rethought in the light of climate change adaptation and material scarcity. Parks are not just for aesthetic pleasure or exercise but treat stormwater, form animal highways and restore the ecological conditions of previous eras. These works form new, more ecologically benign systems with which buildings can connect and around which water tanks and gutters are to be screened from debris and insects, refuse is to be carefully sorted and sealed, and ‘vermin’ are kept at a distance.

Only recently have architectural historians begun to extend the genealogy of tropical architecture to periods before its institutionalisation in the post-colonial era of World War II. Scholars such as Vandana Baweja, Jiat-Hwee Chang and Anthony D. King have noted the indebtedness of tropical architecture to sanitary discourses about tropical hygiene from as far back as the 18th century. Baweja, for instance, traces the prehistory of tropical architecture back to late 19th and early 20th century discourses on the tropical hygiene of European bodies. She starts with the institutionalisation of tropical medicine during the 1890s, but pays most attention to the differences between discourses of tropical architecture in the pre- and post-World War II era, in particular the appreciation of vernacular architecture.

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5 Consider, for instance, the range of positions represented in Charles Waldheim, ed. *The Landscape Urbanism Reader* (New York: Princeton Architectural Press, 2006).

Chang and King, in their article “Towards a Genealogy of Tropical Architecture”, introduce an element of periodisation into this prehistory by proposing three distinctive ‘moments’. The first moment, from the 18th century, involved the ‘transculturation’ of neoclassical architecture to British colonies in the tropics and included the appropriation of many indigenous environmental technologies. The second, from the late 18th century, witnessed the emergence of a universal, standardised body of knowledge within the fields of medicine and military engineering concerning ‘building in the tropics’ that displaced earlier localised adaptations. They identify the third moment as an early-20th century extension of medical concerns about European health in the tropics to indigenous peoples, reflected in the sanitary reform of ‘native’ housing and colonial cities. Chang and King frame tropical architecture as a ‘colonial power-knowledge’ and view the extension of this knowledge to labourers’ housing and ‘native’ quarters in colonial cities such as Singapore during the early 20th century as an extension of colonial governmentality.

Histories of tropical architecture, however, largely gloss over the implications of germ theory for building construction in the early 20th century. Baweja explores aspects of tropical building construction but concentrates on the indigenisation of modern materials rather than any medical influences. Chang, in his most recent book, *A Genealogy of Tropical Architecture*, looks at how miasmatic theories affected the construction of barracks in the 19th century but does not extend this to include germ theory in the 20th century. Instead, he explores how germ theory was implicated in town planning regulations and environmental surveys of ‘native’ areas in Singapore. Looking at the early 20th century sanitary regulation of ‘native’ housing in Singapore, he sees the continued validation of light and air by doctors as a form of ‘contingent contagionism’ which combined the contagionist thinking of germ theory with the earlier environmentalism of miasmatic theory.

As this chapter shows, however, germ theory, in particular the mosquito-malaria hypothesis, also affected the construction of buildings and had some significant conceptual implications.

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implications for building technology. The competing logics of segregation and environmental admittance meant that anti-contagionist measures often undermined climate control and vice versa. Perhaps most significantly, anti-malarial features on buildings during this ‘third moment’ increased the apparent separation of the human and animal world.

This chapter nonetheless builds on these studies to further examine the role of the house in manuals and journals of tropical health and hygiene in this ‘third moment’. As Baweja has noted, tropical architecture was a transnational and inter-colonial discourse; metropole-colony diffusionist models of information flow are too simplistic, as they ignore the way that researchers and practitioners from different countries collaborated both within the tropics and between metropolitan centres. Deborah J. Neill has made a similar but more detailed argument about the sharing of information between British, French and German doctors in Africa despite rising tensions between European imperial powers in the run-up to World War 1. Tropical medicine’s institutional formation, networks, political, colonial and architectural influences have all been considered in detail and many writers have used David Arnold’s memorable term ‘tropicality’ to explore the ‘otherness’ of tropical nature in medical texts, handbooks, sanitary proposals and debates. Arnold has argued that the tropics were as

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much a space of the European imagination as a real place. Since the first ‘voyages of
discovery’ in the 15th and 16th centuries, they have been seen as Europe’s environmental
‘other’, alternating between the tropes of an abundant Eden and a menacing, pestilent,
untamed world.12

Debates about tropical housing were not confined to the medical profession in one
empire or journals from one metropolis but circulated among interested parties in a number of
colonial and metropolitan centres, particularly in the British Empire and the American world
(Extending into the Pacific, South-East Asia and Central America). While many of the
manuals on tropical hygiene addressed a general audience, they also informed medical
debates about lifestyle, construction methods and other practical requirements for residence
in the tropics. For example, Charles Woodruff, an American army medical officer, published
on his return from Manila a popular treatise on The Effects of Tropical Light on White Men. It
was developed from a paper first presented to the Manila Medical Society in 1904. That
paper was an attempt “to prove or disprove the paper read by Von Schmaedel in a paper read
before the Anthropological Society of Munich in 1895”.13

Woodruff’s thesis that the tropics were unsuited to the long-term acclimatisation of
Europeans on account of the physiological effects of tropical light on their skin was strongly
rejected by the Chief Health Officer of Tasmania, J.S.C. Elkington, in a paper given to the
Royal Society of Tasmania in November the following year.14 At the same time, Woodruff’s
ideas on tropical housing influenced Khartoum’s municipal engineer, W.H. McLean, in his
notes on ‘Dwelling Houses in the Tropics’ published in the Wellcome Institute’s Third
Annual Report in 1908. In Woodruff’s case, then, we find a theory proposed in one of the
metropolitan centres of the German Empire, developed ten years later in the Philippines, a

"Tropical Climate and Moral Hygiene," 106. Lilian Chee and Jiat-Hwee Chang, "Introduction – ‘Tropicality-in-

12 David Arnold, The Tropics and the Travelling Gaze: India, Landscape and Science, 1800-1856 (Seattle:

13 Charles A. Woodruff, The Effects of Tropical Light on White Men (New York, London: Rebman Company,
1905), v.

Printer, 1905), 4.
newly acquired imperial possession of the United States, then circulated to the English-speaking world by means of a book publisher in London and New York, only to be rejected in Tasmania, but used three years later by the Wellcome Institute in Sudan for guidance on design principles for dwellings.

Such transnational flows and exchanges, structural and otherwise, proliferated during Chang’s and King’s ‘third moment’, which defines the historical period of this thesis. It is, therefore, worth extending a number of their claims about what distinguishes this period from those that preceded and followed it. While they acknowledge that this ‘third moment’ might seem like a continuation of the earlier emphasis on abstract systems of knowledge, they distinguish it in two ways. First, it was not just concerned with European wellbeing but also sought to reform ‘native’ conditions; secondly, they note that “germ theory, as the prevailing paradigm of medical knowledge, had replaced miasmic theory”—a shift, therefore, in the basic premises of tropical health.15 They argue that the earlier plan forms and environmental technologies developed so that tropical dwellings could ameliorate the effects of miasma in the mid-19th century continued to hold sway in the age of germ theory. Yet even if miasmic theory, with its emphasis on pure air and pure soil, continued to influence architectural planning and technologies, in what way did new vector theories of disease transmission alter the perception of environmental risk and the role of the house and its occupants in countering such risks? What design problems, in other words, did these new theories of disease transmission introduce? Secondly, when the discourse of tropical architecture was extended to the housing of indigenous peoples, in what way did medical experts specify what building technologies were expected to do for different colonial subjects? At a time when disease was understood to be borne by insects rather than the atmosphere, were all subjects protected equally or was tropical hygiene only selectively applied?

This chapter argues that germ theory created a new way of seeing the world, in which animals and micro-organisms posed a new threat to human health. Few of the texts on tropical hygiene between the middle of the 19th century and the early years of the 20th pay much attention to the problem of ‘vermin’, yet by the 1920s and 1930s the tropical house was

expected to be “bat-proof and rat-proof”, as Raphael Cilento famously put the matter. As the health risks associated with animals and micro-organisms became identified and isolated in the laboratory, many public health officials revised their advice on how to build in the tropics. Many of the earlier technologies that health reformers concerned with the tropics had advocated since the 1860s provided a comfortable home not just for people but also for animals. The multi-layered approach to building envelopes, which sought to use the non-conducting properties of air to insulate the interior from the exterior environment, also created a series of interstitial spaces in walls, roofs and under the floor where animals and flies could shelter. In addition, when houses were sited and designed to promote natural ventilation as a means of diluting any poisons in the air, the many openings also created passages for insects and other animals (and, hence, disease) to enter the building.

The house itself in the early 20th century became a laboratory for researchers in tropical medicine, a site for testing practical ways of preventing the transmission of malaria by mosquitoes to the human body. The chapter examines three interrelated case studies in Italy, Panama and the Federated Malay States in the context of the longer history of thinking around the relationship between housing and tropical disease control. These accounts of experimentation in the home, especially with screening technologies, demonstrate the interaction of tropical medicine, housing design and the colonial project in different tropical settings. They also demonstrate the growing mastery of medicine over the tropical world, just as they expose the ruthlessness with which doctors were willing to undertake experiments, placing often unwilling subjects in harm’s way.

These cases, and the broader history to which they belong, thus position the house as a setting through which control was exerted on two distinct though interconnected levels: the political subjugation of the colonial subject and the scientific subjugation of the human subject along colonial lines. They explore architecture’s variable agency in the efforts of public health officials to address what was commonly framed as a native resistance to public health measures by adopting technical recommendations that sought to ‘design out’ the unwanted domestic behaviour of colonial subjects in the name of disease control. The discussion exposes the assumptions that public health officials fostered about how native

peoples lived at home in various settings and the distinct risks they believed this posed to European health. By examining the identified risks to specific medical problems in relation to defined technical solutions, this chapter positions the tropical house as a concern located between public health and social order.

The Climatic Prison

Throughout much of the 19th century, Europeans were pessimistic about the prospects of being able to live in the tropics without ill effects on their health. While tropical nature appeared lush and a source of prosperity, the climate appeared to sap the spirit of any visitor who spent much time there. Without the benefit of modern knowledge of the direct cause of the many diseases encountered in the tropics, doctors tended to blame the climate, consistently distinguishing it from that of a temperate Europe that was free of the diseases encountered closer to the equator. They therefore sought to remedy the situation faced by Britons - indeed all Europeans - in the tropics by limiting their exposure to sunlight or hot or damp atmospheres. This environmentalist theory of health reached its apotheosis in the years following the Indian Rebellion against the controls imposed by the East India Company (EIC) in 1857-8.17

In the aftermath of the Rebellion, the British government took control of the subcontinent and sought to increase the number of British troops stationed there. Most Britons in India were already in the employ of the army, and this would only increase as the EIC handed power over to the British government. However officials were concerned by increasingly high rates of hospitalisation and mortality among British troops stationed in India.18 In 1859, Joseph Ewart of the Bengal Medical Service published a report that seemed

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17 For the negative shift in European attitudes to the tropics brought about by medicine see Harrison, *Climates and Constitutions*; Arnold, *The Problem of Nature*, 149-162.

18 In the aftermath of the Crimean war and Florence Nightingale’s criticism of the appalling hospital conditions, the British military was under pressure to reform its standards of sanitation. This started with inquiries into the sanitary and health standards of the Home Army in 1857 which, following the Indian Mutiny, Nightingale lobbied to extend to the Army in India. In each case, a Royal Commission was appointed and a Barracks and Hospital Improvement Committee (BHIC) was formed to make recommendations about better military building design. The Royal Commission on the Sanitary State of the Army in India released its report and
to bear out a view that European constitutions were fundamentally unsuited to long-term residence in a tropical environment. He showed that 5.58% of European soldiers died on duty in the Bengal Army between 1818 and 1845, a mortality rate far higher than that of their Indian counterparts, the sepoys, among whom 1.19% died during the same period. On top of that, as David Arnold notes, European soldiers in India spent an average of one month a year in hospital—a significant toll for each individual and an extraordinary financial burden on the Empire. Yet with the high political and economic value placed on British control of India, demilitarisation was not an option. Instead government officials were amenable to suggestions by the medical fraternity that the siting, sanitation and thermal performance of barracks could make a tour of duty more tolerable, if not completely disease-free.

The medical community tentatively advanced strategies of environmental risk management. Their anxiety about an inevitable expansion of British military presence in India is palpable in a number of the reports and treatises published between 1858 and 1862. To the Anglo-Indian physician and inventor Julius Jeffreys, doing a tour of duty in India was a form of “climatic imprisonment” that ended “for the most part in death”. Jeffreys, like

recommendations in 1863 and the BHIC for Indian stations published its report in 1864. Chang argues that the BHIC laid the foundations for 20th century tropical architecture’s attitude that basic building types could be acclimatised across vastly different climates and cultures with only slight technical modifications. Chang, A Genealogy of Tropical Architecture, 77.


David Arnold, Colonizing the Body, 65.


Jeffreys, The British Army in India, 217. Julius Jeffreys (1800-1877), surgeon and inventor, was the son of a clergyman to the East India Company and lived as a child in India from 1802 to 1810. After medical training in London and Edinburgh he returned to India in 1822, initially as assistant surgeon based in Calcutta Hospital. Later he moved to Agra, where he was based for most of his time in India. He returned to England in 1835 for health reasons and remained there until his death. Jeffreys was best known for his views on the ventilation and
many sanitary reformers in the mid-19th century, was pessimistic about the health outcomes of British soldiers sent to the tropics. He argued that soldiers sent to India were treated worse than felons and subjected to, as he put it, “the minor alarm and injury of transportation to a tropical climate”. Jeffreys was convinced that many tropical diseases could only be cured by leaving the hot conditions that seemed to produce them:

A man who has jungle or remittent fever will have relapses, and generally die, if he has not change of climate; and he is ever afterwards more susceptible than previously. This is also the case, though in a somewhat less degree, with cholera and dysentery.

Like many of his peers, Jeffreys believed that the environment was the cause and cure of many medical conditions and this had social and political consequences. When Jeffreys wrote about climate, he highlighted its role in making Europeans seem feeble and out of place and of the consequences of its effects, therefore, for colonial rule:

Man, everywhere, is likewise disposed to look upon that climate which suits him best, as the proper one, and upon the native of a different clime, who sickens and declines in the former, as a “poor creature” of a feeble constitution. The natives of India look upon us as white bears from the cold unhealthy North, ferociously brave, but of sickly constitutions, disabling us from occupying their country without their aid.

The belief that diseases in India were more potent than their European counterparts opened up a gap between European and Indian medical practice, with increasing medical scrutiny of Indian geography, climate and topography undertaken to explain the differences between the two conditions. Indeed, as Mark Harrison has noted, “there was a constant tension at the heart of much writing on India’s climate: between climate as a signifier of difference on the control of heat in buildings both in India and in Britain. He continued to advocate better ways of constructing buildings in the tropics after his return to England publishing his work on the British Army in India in 1858. Oxford Dictionary of National Biography. Accessed December 20, 2016. http://www.oxforddnb.com/view/article/14706.

23 Jeffreys, The British Army in India, 217.

24 Jeffreys, The British Army in India, 49.

25 Jeffreys, The British Army in India, 14.; See also Moore, Health in the Tropics, 61.

26 David Arnold, Science, Technology and Medicine in Colonial India (Cambridge: Cambridge University Press, 2000), 76.
one hand, and climate as a transformative force”. 27 Climate may well have exacerbated the estrangement of colonial officers but finding ways to deal with it was considered an imperative of colonial medicine.

The Climatic Enclave

Where medicine lacked a cure for infections once contracted, preventative medical practices were expected to reduce the risk of infection itself. As Caroline Hannaway has noted: “The inability to control the climate or geography meant that self-preservation or avoidance of disease had to focus on specific elements in the personal environment”. 28 Unsure of the exact cause of disease, but convinced that climate, miasmas and weakened constitutions all played a part, doctors advocated strategies of preventative health, ranging from environmental retreat to elevated hill stations, the careful siting of barracks in relation to wind and water bodies and a range of technical devices to improve airflow in buildings.

Unsurprisingly, while Jeffreys placed great emphasis on climate as cause and cure of tropical ills, he was also a proponent of hill stations—elevated health resorts for the recuperation of soldiers from tropical disease. Indeed it was he who, as a 23-year-old surgeon with the Indian Medical Service in 1824, extolled the curative value of the Himalayan climate of Simla, 29 which would later become the summer capital of the British government in India. Its lower air pressure, drier, cooler and more equable climate were all valued for the reduced pressure they were said to place on the skin and brain, and consequently their supposed recuperative power from disease. Jeffreys’ case was well received by the Government of Bengal and he claimed credit for the establishment of hill stations at Simla, Mussoorie and neighbouring Landour. 30

27 Harrison, Climates and Constitutions, 25.


29 Jeffreys, The British Army in India, 242-55.

30 Jeffreys, The British Army in India, vii.
In promoting the health benefits of the Himalayan climate, Jeffreys proposed the establishment of the hill stations as climatic enclaves, a form of thermal respite from the climatic prison that he claimed India to be. This strategy would become one of the features of colonial cities in the tropics, from Darjeeling (1839) beside Calcutta in India, to Dalat (1893) above Saigon in French Indochina, the Cameron Highlands above Singapore in British Malaya (1888-1931) and Petropolis (1843) above Rio de Janeiro in Brazil. Indeed, as we shall see in the next chapter, the geographical search for thermal refuges or, as I call it, thermal prospecting, would be a feature of tropical medicine’s incursion into geography and urbanism well into the 20th century.

For medical authorities, the hill stations were primarily valued as climatic refuges. Yet they also provided refuge from questions about how best to build in India. Though he also gave detailed recommendations on the design of military barracks for the hot Indian plains, Jeffreys had nothing to say about how they should be designed in elevated climates. His friend, Sir James Ranald Martin, then one of the foremost British authorities on tropical sanitation, provided few detailed recommendations but thought the majority of British troops should be stationed in the hills. Martin argued that as long as there was adequate drainage,

31 For an outline of Dalat’s history see: David M. Pomfret, “‘Beyond Risk of Contagion’: Childhood, Hill Stations, and the Planning of British and French Colonial Cities,” in Imperial Contagions: Medicine, Hygiene, and Cultures of Planning in Asia, ed. Robert Peckham and David M. Pomfret (Hong Kong: Hong Kong University Press, 2013), 92-102.


33 Cited by Jeffreys, The British Army in India, 155. Sir James Ranald Martin (1793-1874) was a Scottish-born doctor who rose to prominence as a surgeon in the East India Company. His promotion of medical topography and sanitary measures based on Western rather than Indian medical practice altered the way that British doctors and officials viewed Indian sanitary habits, particularly after the publication of his book Medical Topography of Calcutta in 1835. This marked a shift from purely climatic explanations of health outcomes to the effects of indigenous sanitation on Europeans. He left Calcutta for London in 1840 due to ill-health and retired there. Martin went on to edit and revise later editions of James Johnson’s The Influence of Tropical Climates on European Constitutions, the key textbook on the practice of medicine in the tropics. Following the Crimean war in 1857, he played an active part in the sanitary reform of the British Army and was a member of the royal commissions that looked at the sanitary state of the British army in the Home Countries and India.
clean water and some open space, then simple, well-built structures would suffice. “Such simple and cheap structures will, I believe, prove more conducive to the health of the European soldier on the mountain-ranges of India, than the most costly barracks”.  

Even when more detailed recommendations were provided, such as those by W.J. Moore of the Bombay Medical Service, they tended to be less stringent for buildings located in hill stations than for those in the plains. Regarding ventilation, for example, Moore was not troubled by buildings in hill stations being oriented at an angle to the prevailing breeze, but he took more care with buildings located in the plains. As he explains:

> In elevated regions, however, on account of the diminished temperature, and the greater coolness of the breeze, barracks, &c., may be erected at considerable angles the quarter from whence the wind blows; and although I cannot conceive it possible for any person to recommend the erection of barracks gable-end on to the wind, as the barracks at Aboo at the present time are situated, still the ground may often only admit of a diagonal direction being taken.

Medical experts had less interest in regulating the design and siting of hill station buildings since the sites were already seen as inherently healthy by dint of their climate. Instead, the hill stations, where leisure time was given medical respectability, served as an escape valve for Britain’s colonial administrators and their families. Their cool climate, remote location, relative inaccessibility and concentration of British residents all served to heighten their attraction as sites of picturesque nostalgia. The climatic enclave was also a social enclave, a counterpoint to the military cantonment on the hot plains. As a social enclave it was a place for the British to withdraw from their colonial experience and the regulation of their own

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34 Martin, Letter to Chairman of Court of Directors, 1857, quoted by Jeffreys, *The British Army in India*, 100.

35 Moore, *Health in the Tropics*, 102. Sir William James Moore (1828-1896) joined the Bombay Medical Service in 1852 and, aside from serving in the Persian War between 1856-7, was based in India until his retirement in 1888. From 1862, he was residency surgeon in a range of locations in what was then Rajputana. He moved to Bombay in 1877 to become deputy Surgeon-General. He finished his career as Surgeon-General and was knighted in 1888. He died in London in 1896. See C.E. Buckland, *Dictionary of Indian Biography* (London: Swan Sonnenschein & Co., 1906), 296.

36 For a more detailed discussion of the social history of Indian Hill stations and their role as sites of memory, see Kennedy, *The Magic Mountains*, 49-62.
behaviour. It was for these reasons, as Dane Kennedy has argued, that the British saw little need to impose stringent rules on the development of hill towns. Given the supposed healthiness of the climate, I would also argue that this extended to the design of buildings.

Letting the Air in

Taking refuge from the climate by migration to the hills was not the only strategy advocated by medical experts in the middle of the 19th century. Not every soldier could be stationed in the hills and, for those living in the plains, great emphasis was placed on the adoption of suitable technology, lifestyles and the avoidance of unhealthy environments. Carefully designed clothing and housing and the regulation of diet, exercise and “the passions” could all act as “tropical prophylactics”, as Jeffreys put it. Reformers paid attention to how best to site buildings to avoid the risk of miasma-borne malaria, promote air flow to dilute atmospheric toxins and cool occupants to ensure a good night’s sleep.

In the mid-19th century malaria was thought of not as a specific disease with a unique cause, but as a poisonous ‘agent’ that interacted with certain ecosystems to spread a range of diseases. It was associated in particular with swamps and marshes and was assumed to be caused by bad air (*mal aria*, in Italian), caused in turn by rotting vegetation. While organic matter and the emanations of the sick could all form miasmata, just which individuals would become infected could not be predicted with any consistency. Certain constitutions were thought more susceptible to infection. In particular tiredness, drunkenness and hunger were all thought to weaken the body and place it at more risk of infection. Therefore, it was no surprise (as we shall see) that the design of the bedroom in order to promote good sleep featured prominently in doctors’ guidance for barracks design.

Doctors like Moore and Jeffreys recommended that, in order to deal with malaria, sleeping apartments for troops were better situated on the upper floor than on the ground. There the room could take advantage of airflow for both ventilation and cooling. As still air


38 Jeffreys, *The British Army in India*, iii.

was thought more likely to contain concentrated miasmata, ventilation was favoured to either replace or dilute poisonous air with fresh air. In addition, an oppressive atmosphere was seen to be difficult to sleep in and, with the body thought to be weakened without sufficient rest, a cool apartment was regarded as necessary to preserve a soldier’s health. 40 Mosquitoes, considered more a nuisance than a threat in this period, could also be avoided with air movement. 41 However it would seem to have had as helpful an effect on behaviour as on health. As Jeffreys argued:

[I]f quartered upstairs, the soldier could not be truanting into the sun and glare of the barrack-yard, nor would he feel tempted to do so when he had spacious verandahs to walk and lounge in, with an open and cheerful view over the cantonments. 42

Doctors scorned the licentiousness and heavy drinking of soldiers and it would seem evident that ground level apartments were considered easier to slip in and out of. 43 Instead, pleasure was provided by a picturesque view.

The close attention to miasma by doctors in the 19th century is reflected in the numerous terms used to describe different forms of air movement. Malaria was thought to be “an organic compound, chiefly composed of carbon and hydrogen”. 44 The term “ventilation” in the 19th century referred to the “replacement of impure air by pure air”. 45 As such, ventilation emphasised the dilution and removal of atmospheric poisons. One such method was “natural ventilation” which used breezes to replace impure air with pure air and was most favoured by Moore as a method for Indian barracks. Care had to be taken, however, to ensure that buildings fronted the prevailing winds to ensure “thorough perflation”. Perflation, from the Latin perflare (‘to blow through’), specifically described the movement of outside

40 Jeffreys, The British Army in India, 118; Moore, Health in the Tropics, 125.

41 Moore, Health in the Tropics, 125.

42 Jeffreys, The British Army in India, 118

43 This was not just considered a moral problem but also a health problem. David Arnold notes that venereal disease throughout the 19th century was the main reason for soldiers being hospitalised in India. Arnold, Colonizing the Body, 83.


air through a building due to pressure differences—an action similar to what we would today call cross-ventilation. On a number of occasions Moore discussed the “ventilation and perflation” of a building or vessel, confirming that, at the time in which he wrote, the terms were not technically interchangeable. While perflation could enable the replacement of vitiated air, it could also introduce hot winds into the interior.

Since damp and humidity were thought to encourage the spread of malaria, only certain soils were suitable for the construction of barracks, with Moore expressly forbidding building them on clay soils. Well-draining gravel or sandy soils were much preferred. He further argued against the use of cow-dung for floors, as he believed they produced low levels of malaria, were dusty in summer and absorbed moisture during the monsoon season.

46 Consider these lines from Moore’s Health in the Tropics: “awnings prevent the thorough perflation and ventilation of the ship” (271); “This, however, in hill climates will permit ventilation and perflation which it would prevent in the plains” (102); “If permitted in positions where they intercept the prevailing breeze, they deny thorough perflation and ventilation” (121); “it is not difficult to secure thorough perflation, provided the residence is situated favourably to the prevailing breeze” (130); “All corner rooms, made by partitioning verandahs or otherwise, are most objectionable, being necessarily small, hot, and unventilated, and denying thorough perflation of parts behind” (132).

47 Moore makes this point when he states: “Until some better means for cooling large buildings can be devised, recourse must be had to the old system of tatties, punkahs, and thermantidotes, which, notwithstanding the inconveniences attaching to their use, are unquestionably more conducive to health than allowing the uninterrupted play of the hot and arid wind upon the skin, or, in other words, allowing the surface of the body to act as a tatty.” Moore, Health in the Tropics, 133. Tatties, punkahs and thermantidotes all relied on human power to fan air across a space. Tatties were grass screens placed in front of window openings and watered, by servants known as ‘coolies’, to latently cool the air passing though. Punkahs were large pieces of fabric or panels, suspended high up in the room, and swung from side to side to create air movement. Thermantidotes were large circular fans that could be powered by either animals or humans to ensure a constant current of air.

48 Moore, Health in the Tropics, 125.

49 Moore, Health in the Tropics, 128.
Technical debates from the mid-19th century about tropical ventilation reveal how thermal performance and sanitation could end up at odds with each other in the search for perfect air. In his advice, Moore was much more specific about drainage and the avoidance of damp than his fellow surgeon Jeffreys, and he took issue with a subterranean ventilation system proposed by Jeffreys in 1858. Jeffreys’ system (fig 1.1) consisted of a network of linked underground wells placed to the front of the barracks and intended to provide permanent tempered air to the barracks, heating it in winter and cooling it in summer. Jeffreys was concerned that the standard system of ventilating barracks using punkahs, tatties or thermantidotes relied too heavily on servants, whom he thought unreliable:

Even with a large and costly establishment of bullocks to draw water, of bheesties to carry it, and of coolies to splash it upon the tattees, constant vigilance is necessary to keep them from becoming dry through the insatiable thirst and the lassitude or indolence of the purveyors of water to it. ⁵⁰

Jeffreys’ proposal therefore tried to make tempered air predictable, avoiding the problems of dealing with servants or unreliable winds. Moore, writing four years after Jeffreys made his proposal, critiqued the scheme not for its thermal performance but for its drainage issues. The

⁵⁰Jeffreys, *The British Army in India*, 129.
neglect of drainage, Moore argued, “will as surely give rise to the generation of malaria and malarious fevers, as attention to this point will prevent their occurrence.” Moore was more concerned with environmental contamination than with environmental heat, fearing the aggregation of multiple health risks. Moore believed Jeffreys’ system would only work with strong winds and feared that the “air so passed through the ground would become saturated with damp and malaria, as, indeed, is reported to be the case when the system was tried, thirty five years since, at the Cawnpore European Hospital”.

Even though doctors writing on India were largely in agreement as to the benefit of hill stations and the need to site buildings so as to promote ventilation and avoid malaria, the regulation of the thermal environment still created both social and technical problems. There was little emphasis, for instance, on the health and welfare of the Indian population. After all, colonial medicine during the 19th century concerned the welfare of the colonists, not their subjects. Arnold calls this stance “enclavism”. Even within these ‘healthy’ enclaves, however, general strategies of avoidance, dilution of toxins and promotion of cooling did not always operate in conjunction with one another. Where strategies of avoidance through elevation were advocated, as in the case of the hill station, technical treatment of the building construction itself was considered less relevant, as was its orientation (as noted above). Working from a theory of miasmata that eluded direct scientific observation, the strategies intended to preserve the health of both the colonist subject and the colonial enterprise did not so much form part of a comprehensive system as a suite of preventative measures that succeeded (when they did) quite by accident. Within this medical campaign, animals were also considered an annoyance, but not the threat to health that Alphonse Lavaran discovered them to be when, in 1880, he identified mosquitoes as the cause of malaria, thereby rendering the logic of the aforementioned intersections of architecture and tropical health obsolete.

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52 Moore, *Health in the Tropics*, 133.  
Lavaran’s finding that malaria was caused by parasites rather than poisons flew in the face of conventional wisdom about the disease. At the end of the 19th century, not all doctors accepted his thinking, but a number of researchers, among them Giovanni Battista Grassi and Angelo Celli in Italy, Sir Patrick Manson in Britain and Sir Ronald Ross in India, endeavoured to push Lavaran’s experimental work forward. Malaria was seen as an impediment to modernisation. In recently unified Italy, the disease was on the doorstep of its revived capital city, Rome. Italy was expanding its railways, but passing a line through the malarious Campagna region exposed workers to considerable risk. For Britain, like its imperial rivals, malaria was still a disease of empire, but with the ‘scramble for Africa’ and incursions into East Asia, its commercial and imperial interests had expanded greatly since the 1870s. With trade and empire, however, came malaria, along with calls to protect workers and officials.54 Ports in the tropics, like Port Swettenham in the Federated States of Malaya or Port Louis in Mauritius, were often found near low-lying malarious swamps, as were river capitals like Khartoum in Sudan; the construction of the Suez canal created its own problems with malaria.

Flies posed a menace as never before. Sir Patrick Manson had shown in 1877 that mosquitoes acted as intermediate hosts in the spread of filarial parasites and speculated in 1894 that they were also responsible for the spread of malaria. Independently, between 1897 and 1898, Grassi and Ross did the fieldwork necessary to prove Manson’s mosquito-malaria hypothesis and identified the Anopholes mosquito as responsible for transmitting malaria between humans.55 As the transmission of malaria came to be understood, efforts turned to its prevention, with Ross, Manson, Angelo Celli and others all giving their own recommendations.

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54 See Watson on how a malaria outbreak affected port operations and business at Port Swettenham. Malcolm Watson, The Prevention of Malaria in the Federated Malay States (Liverpool: The Liverpool School of Tropical Medicine, 1911), 26-27.

55 For an account of Grassi’s and Ross’s roles in the development of understanding on malaria see Ernesto Capanna, “Grassi versus Ross: Who Solved the Riddle Of Malaria?,” International Microbiology 9, no. 1 (2006), 69.
It is noteworthy that, at the turn of the 20th century, there was no one way of preventing malaria. Ross himself declared war against mosquitoes and advocated military tactics to get rid of the flies—a combination of surveillance and extermination of mosquito breeding grounds. The famed German bacteriologist Robert Koch advocated a chemical solution, with the mass use of quinine to inoculate against the disease.

Architectural solutions were among the first suggested by both Celli and Manson as a preventative measure against malaria. The building interventions they proposed allow us to see how new theories of disease transmission reworked architecture and how doctors at this time conceptualised buildings. The screen was clearly a device of conceptual importance. In general, screening created spaces of isolation that separated people from animals, and also the healthy from the sick. Yet the screens also had a communicative role, being a very visible and physical form of defence against the omnipresent fly.

Despite the nationalism bubbling under the surface of the science, commentary and institutional involvement in testing medical hypotheses, experiments on the screening of buildings provide a clear instance of tropical medicine as a transnational enterprise and demonstrate that technical ideas on hygiene moved between empires and nations with relative ease. At the same time, quite distinctive attitudes emerged between the British and Italian researchers as to who would best benefit from screening and when the expense was justified.

At the turn of the 20th century, Sir Patrick Manson was searching for a practical means to demonstrate how people could protect themselves from malaria. Widely regarded as the father of tropical medicine, Manson was in 1899 the medical advisor to the Colonial Office and the founder of the new London School of Tropical Medicine, which opened in that year. Sir Ronald Ross in India, and Giovanni Batista Grassi in Italy, had already

56 For a detailed account of Ross’s tactics see his book Mosquito Brigades and How to Organise Them (London: Longmans, Green, and Co., 1902).
57 On the different imperial cultures of malaria treatment in the early 20th century, see Neill, Networks in Tropical Medicine, 89-92.
58 Sir Patrick Manson (1844-1922) studied medicine at Aberdeen University and travelled widely through imperial networks during his early career. Starting in Taiwan in 1866 as a local medical officer with the Chinese Imperial Maritime Service, he moved to Xiamen in 1871 where he became interested in problems of elephantiasis. Through his research later in the decade, he came to realise that elephantiasis was caused by the
presence of microfilaria, or tiny worms, in the blood. He later proved, in 1877, that these were transmitted to the blood by mosquitoes. When he began to look at the causes for malaria, his earlier insect-vector hypothesis for filariasis formed the basis for his mosquito-malaria hypothesis in 1894. He argued that mosquitoes acted as the intermediary hosts in the transmission of malaria. Following six years in Hong Kong (1883-1889), Manson returned to Britain where he became increasingly involved with institutionalising tropical medicine. He was appointed as medical advisor to the Colonial Office in 1897 and lobbied government to help found the London School of Tropical Medicine in 1899 to improve the training of doctors sent into service in Britain’s tropical colonies. His textbook on Tropical Diseases from 1898 would become the standard in the field; indeed, today, *Manson’s Tropical Diseases* is still being published and has entered its 23rd edition. Oxford Dictionary of National Biography. Accessed December 20, 2016. http://www.oxforddnb.com/view/article/34865.

59 Sir Ronald Ross (1857-1932) was a Nobel prize-winning malariologist. He was born into an Anglo-Indian military family and spent his early childhood in India before moving to England for schooling. He studied medicine at St. Bartholomew’s medical school in London. On graduation he joined the Indian Medical Service and was posted to Madras in 1881, seeing practice across India and Burma over the following two decades, with intermittent return visits to England. During this time he was encouraged by Sir Patrick Manson to develop Manson’s mosquito-malaria hypothesis through fieldwork in India. Ross managed to demonstrate the lifecycle of malaria parasites and their movement between mosquitoes and avian blood for which he won the Nobel Prize in 1902. He was sure that malaria was largely carried by the anopheles mosquito and that it was quite easily controllable, a factor that helped Manson to lobby for the relevance of the London School of Tropical Medicine. Ross retired from the Indian Medical Service in 1899 and was appointed to the newly founded Liverpool School of Tropical Medicine which would develop a friendly rivalry with the London school. As well as lecturing he spent much of the first decade of the 20th century advising on malaria control in Ismailia, Greece, Cyprus and Mauritius and observing mosquito control measures in Panama. After his return from India in 1898, the later part of Ross’s life, despite his awards, was marred by frustration and pique against any potential rivals who might claim prominence in tropical medicine. Ross was very protective of his legacy. He fell out with his mentor Manson and developed a fierce rivalry from the end of 1900 with the Italian zoologist Giovanni Grassi. Oxford Dictionary of National Biography. Accessed December 20, 2016. http://www.oxforddnb.com/view/article/35839?docPos=1.

60 Giovanni Battista Grassi (1854-1925) was an Italian zoologist widely heralded for isolating the anopheles mosquito as the main vector for transmitting malaria to humans. Born near Milan, he studied medicine at the University of Pavia but went on to specialise in zoology, completing his training at the University of Heidelberg. Grassi was professor of comparative anatomy at Catania where he became interested in the malarial cycle in birds. He moved to Rome in 1895 to become Professor of Comparative Anatomy at the University of Rome and came in contact with a group of malariologists, among them the professor of hygiene, Augusto Celli (1857-1914), and medical colleague Ettore Marchiafava (1847-1935) who believed some kind of insect was responsible for the transmission of malaria. It was Grassi who systematically concluded that the anopheles mosquito was responsible for this and published his results in September 1898. Three months later, in December
demonstrated that the Anopheles mosquito could incubate and transmit the malaria ‘germ’ into human blood, confirming Manson’s own insect-vector hypothesis. Nobody, however, had shown the British public or, more importantly, the Colonial Office, how the disease could be avoided.

Manson was impressed by alterations made to a farmhouse near Tivoli, carried out under the instructions of Angelo Celli in 1899.61 The marshes around Tivoli were considered highly malarious and were the object of study by a number of Roman researchers. Celli had

1898, Grassi along with colleagues Bignami and Bastanielli, let the Italian Lincei Academy know that their field and laboratory work had demonstrated that the anopheles mosquito could transmit malaria to an uninfected man in a non-malarious region. Despite this, Ross received the Nobel prize, not Grassi and his colleagues, a fact that led to their falling out. Grassi continued to study the anopheles mosquito until close to his death in 1925. The work of Grassi and his disciple formed one of the main prongs that enabled Italy to rid itself of malaria. By identifying the exact vector for malaria transmission through biological and chemical control, they helped eradicate malaria. See Capanna, Ernesto. "Grassi Versus Ross: Who Solved the Riddle of Malaria?". International Microbiology 9, no. 1 (2006): 69-74.

61 Angelo Celli (1857-1917) was born in Cagli, studied medicine in Rome and continued his studies in Munich under the pioneering hygienist Max Von Pettenkofer before returning to Rome. He was appointed professor of hygiene in Palermo in 1886 but left the following year to take up a position as Professor of Hygiene at the University of Rome. Celli took an early interest in the malarial work of the French physician, Alphonse Laveran (1845-1922). Laveran, in 1880, discovered that malaria was a parasitic disease. But it was Celli and his colleague, Ettore Marchiafava (1847-1935) in Rome, who in 1885 gave the parasites a name – \textit{plasmodium malariae}. From 1889 Celli became interested in the lifecycle of the malarial parasites and how they varied with the season. He dedicated himself not just to identifying the cause of malaria, but also its prevention. Having come from a modest background himself, Celli attempted to ensure that even peasants were protected from flies. This led him to advocate a set of practical interventions for those living in malarial zones – windows should be screened and residents should honour a curfew from sunset to sunrise to prevent mosquitoes ingressing. As well as his housing work, Celli also convinced the government to legislate to fund the quininisation of populations in malarial zones. He also sought to educate the rural poor about the effects of malaria and its transmission. Alongside Celli’s political interest, he was a keen participant in and founder of medical publications and institutions. He founded the journal \textit{Annals of Hygiene} in 1889, the Society of Medicine and Tropical Medicine in 1890 and the Society for Studies of Malaria in 1898. He was head of the society of hygiene from 1908-1911. Celli published widely and his books on malaria became textbooks in themselves. He was survived by his wife and collaborator Anne Fraetzel. Arnaldo Cantani and Marina de Marinis, “Celli, Angelo” in \textit{Dizionario Biografico degli Italiani} (Rome: Istituto della Enciclopedia Italiana Fondata da Giovanni Treccani, 1979). Accessed December 20, 2016. http://www.treccani.it/enciclopedia/angelo-celli_(Dizionario-Biografico).
ensured that the doors and windows of the farmhouse were fitted with mosquito nets and had instructed the occupants on the health risks from mosquito bites. At the end of the malaria season the woman and child of the house were in good health but the husband, whose work took him out of the house at night, suffered from severe bouts of the disease. Manson saw in Celli’s work a means of convincing the Colonial Office of a practical way to protect British public servants overseas and the potential to demonstrate to a sceptical British public the reality of mosquito-malaria transmission.\(^{62}\) To further prove the danger of mosquitoes, the second part of the experiment involved infecting volunteers in England with malarious mosquitoes transported from Rome.

In April 1900, shortly before the experiments took place, Manson explained his motives to a sympathetic audience at the Royal Colonial Institute:

> Similar results have been successfully made before, so that for the malarialogist positive results, provided the proper conditions are complied with, are a foregone conclusion. But the experiments have never been combined in the crucial way proposed, or carried out in what I might call so dramatic a way and in a manner so calculated to carry conviction to our countrymen at home and abroad. Should they eventuate in the way we believe they will, this will encourage the Colonial Office to go forward in the direction now clearly indicated, and will prepare those for whose education the experiments are intended to adopt such measures as experts may devise for protection from malaria.\(^{63}\)

Manson was aware that, taken alone, neither experiment was particularly original. The point, however, was to convince not the scientific community but the general public and Colonial Office. What was required was a little drama and a lot of cunning. Rather than rely on Celli’s alterations to Italian farm buildings, Manson lobbied the Colonial Office to pay for a prefabricated hut to be purchased and shipped from London to Rome. Manson’s choice of a prefabricated building was not accidental; his focus was firmly on Britain’s tropical colonies,


\(^{63}\) Patrick Manson, "A School of Tropical Medicine," *Journal of the Royal Colonial Institute* 31, no. 5 (1900), 320-21.
which also had a long history of receiving “portable colonial cottages”. On January 19, 1900, he set out his proposal in a letter to the Colonial Office:

This being the case I consider it highly desirable that an effort should be made at once to test this matter by additional experiments. I would suggest a small galvanised iron or wooden building consisting of two or three rooms and specially designed for the exclusion of mosquitoes and for use in tropical countries to be made in this country and subsequently shipped to Rome and erected in the same notoriously malarial spot in the Campagna. This should be done before the commencement of the malaria season. A competent volunteer, or volunteers, might be induced to live during the night in the building throughout the summer and autumn, observing the precautions against malarial infection as in the experiments referred to by Professors Celli and Grassi. If it be found that the experimenters remain free from malarial infection, the important fact that malaria is preventable by simple and practical means will be established, and a valuable method for the preservation of health in our malarial colonies be clearly indicated.

Manson’s proposal directly replicated Celli’s experiment but, rather than use Italian peasants as guinea pigs, he sought “competent volunteers” who, in the end, were his colleagues at the London School of Tropical Medicine, Drs Luigi Sambon and G.C. Low, their Italian illustrator, Amadeo Terzi, and a servant, ‘Silvestri’. Sambon and Low later noted that, although Celli’s experiments were effective, some doubt was cast over their results since the occupants had been affected by malaria earlier in their life. In contrast the British researchers had never once been attacked by the parasite. Sambon and Low were to

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65 Manson to Colonial Office, 19 January 1900 quoted by Manson-Bahr, History of the London School of Tropical Medicine, 98-99.


collect mosquitoes by day, while Terzi was contracted to draw them up and paint landscapes for future publication. Joseph Chamberlain, Secretary of State for the Colonies, supported the proposal, also supporting Manson’s request for assistance from the postmaster general to transport mosquitoes back to London.68

The siting of the hut was important to provide conclusive proof of the mosquito-malaria theory. Sambon and Low were searching for a region that was “known as undoubtedly and severely malarious”. The British researchers wanted to maximise the contrast between the healthy researchers and the ill-fated peasants, in a situation redolent of earlier imperial attitudes to health.69 As Sambon and Low later explained:

The presence of unprotected inhabitants was of great importance to us, because the state of their health would serve as an excellent contrast to our experiment; and, moreover, a number of fever patients in the neighbourhood meant a larger percentage of infected mosquitoes, and therefore greater chances of infection.70

They initially considered siting the hut in Cervelletta, near Tivoli, in the same district where Celli had undertaken his experiments. They decided against this, however, lest their own work be considered part of Celli’s experiments. At the same time, they claimed that the region was not “sufficiently malarious”.71 After spending a month tramping around the Campagna and after consulting with Celli and his colleagues, both Ostia and Maccarese were considered possible locations.

The final choice of site was exceptionally strategic and demonstrated their awareness of the propaganda that went with the experiment. Although both Maccarese and Ostia were recommended by the Italian researchers, they decided on Ostia not only because it would be more populated during the summer but also, they reasoned, because it was better known, “having been the port of ancient Rome”.72 Around Ostia, the townland on which they settled

68 Manson-Bahr, History of the London School of Tropical Medicine, 99.

69 For the privileging of European health in the tropics using architecture during the 19th century see Chang and King, “Towards a Genealogy of Tropical Architecture,” 287-93.


was Fumaroli, said to be the most lethal location in malarial terms. It also just happened to contain a game reserve rented by King Umberto, whose interest in the project translated into permission to erect the hut on his land. In their choice of site, then, Sambon and Low had managed to avoid direct association with Celli, though they were replicating his experiment in his own country, while working on a site that would be known to anyone with a classical education. Their experimental design, too, favoured an advantageous result; a successful outcome would see subjects survive in their prefabricated British hut while all around them fell ill.

Figure 1.2. British Experimental Hut. Source: Sambon and Low, “Report on Two Experiments,” 518.

The hut, a kit-of-parts of yellow fir framing, was prefabricated by Humphreys Ltd in London and shipped for reassembly in Ostia (fig 1.2). The total cost, including transport and assembly, was £300 (around AU$56,000 in today’s terms). The seven-room, single-storey dwelling measured 9.75m (32 ft) long and 7.31 m (24 ft) wide, and had a small porch on one side. It was raised on timber piles, with 100mm (4 in) wall framing, lined with timber on both sides and a tongue and groove floor. The timber frame roof was lined with bitumen which was then covered with cement. It was surrounded by cast iron gutters, with metal downpipes. The eaves of the roof overhung the walls by 915mm (3 ft) to shade the building and enable the attic space to be ventilated. Rooms were ceiled and each had a ventilator in the ceiling to draw out air. The eaves and room ventilators were both screened with wire to prevent any

insects entering. All windows opened inwards and were screened on the outside with netting, while doors with upper glazed panels were fitted in the porch. Further protection from mosquitoes was offered by the white painted walls on the interior—“for the easier detection of the mosquito”—and shot-weighted mosquito nets draped from the ceiling to the floor partitioned a corner of each bedroom to safeguard those sleeping within.74

Figure 1.3. Celli's Gabinetto on a Peasant Hut Source: Angelo Celli, "Sulla nuova profilasi della malaria (con le tavole 3-9) - Ricerche del prof. A. Celli," Annali di Igiene 11(1901), 108.

In that year, Celli also extended his experiments with mosquito-proof buildings, trialling a variety of nettings, gauzes and porches. Previously he had used tulle netting to cover windows and protect bedrooms, with wire netting only used for external doors. Celli tested a range of metal and fabric gauzes, noting that steel, zinc, copper and brass were likely to rust and galvanised metals were better suited to a marine environment. He observed that 3 sq.mm gauze prevented the entrance of the culex fly and further recommended self-closing door openings and screening chimney pots if the buildings were located close to trees.

For his 1901 experiments he used wire netting for all external openings and included a metal screened porch, which he called a *gabinetto*, in front of the entrance door (fig. 1.3).

Celli’s description of his *gabinetto* goes beyond simply trying to maintain the occupants’ health but also reinforces aspects of their lifestyle, allowing them to grow food and relax according to normal patterns:

This adds an obstacle to prevent the penetration of mosquitoes; it better protects the ground-floor rooms; one has a space, where in the evening, when it is hot and sultry, the railwaymen in particular, can stay cool in the open without danger of being bitten by these wicked insects; and during the day it can allow climbing herbs to grow outside, which allows one to enjoy the shade.75

The contrast between Manson’s pristine prefabricated hut and Celli’s ad hoc rural extensions could not have been greater. Manson’s hut, prefabricated in London, shipped a ready-made apparatus, deployable anywhere in the world. It was not reliant on a developed building industry at the site, only on transportation networks. Although the siting of the hut was experimental, Sambon and Low made little reference to how it actually performed. All that mattered was that they themselves emerged unscathed. In the final assessment, the hut served, above all, as a publicity stunt for the year-old London School of Tropical Medicine. But it also strengthened Celli’s hand in Italy, showing British interest in his work.76

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75 [my trans.] The original text by Celli: “Si aggiunge così un ostacolo alla penetrazione delle zanzare; si ne proteggono meglio le camere a pianterreno; si ha uno spazio, dove le sere, calde ed afose, la gente, i ferrovieri in ispecie, possono stare al fresco all'aperto senza pericolo di punture dei malefici insetti; e di giorno, se vi si fanno crescere al di fuori delle erbe rampicanti, vi si può godere dell’ombra.” Angelo Celli, "Sulla nuova profilasi della malaria (con le tavole 3-9) - Ricerche del prof. A. Celli," *Annali di Igiene* 11(1901), 109.

76 Manson-Bahr describes the political role of the hut for both Manson and Celli. Manson-Bahr, *History of the London School of Tropical Medicine*, 100.
In contrast to the British experiment, all of Celli’s examples consisted of modifications to existing dwellings, from the simplest reed hut for migrant workers to more substantial railway company dwellings (fig. 1.4). The modifications were made on-site, for a known malaria-prone region close to the kingdom’s capital, not as a test for distant colonies. His trial-and-error approach focused on both occupant and material behaviour and his house attempted to render safe not just the bedroom, but the surrounds of the house as well. This extension of the boundary of the house defined a separate interstitial space, neither completely inside nor outside the house but one that was, nevertheless, ‘insect-free’. It should be noted that, although Manson’s hut was intended as a prototype for the tropics, it had no verandah, relying on the eaves for shading and strictly delineating the interior and exterior world. The screens were fully integrated within the building envelope, whereas Celli’s extensions greatly altered the building form. For all their formal differences, the Italian and British experiments in mosquito-proofing together introduced a new role for the house, intimately connected with the new field of tropical diseases, which enabled the building envelope to intentionally separate the human and the animal worlds.

Celli continued to advocate the benefits of screening, over and above large-scale mosquito eradication measures, which he believed took too much time. In 1900 he sought to
use screening on even the poorest peasant’s house but by 1910 he admitted that “only the minor part of the population, namely the richer and, therefore, the least attacked, can enjoy this benefit”. It was not only a question of wealth, he argued, but of education and culture as well—peasants could not be trusted to remain indoors at night for the screens to be effective. Instead Celli recommended expanding access to quinine; his efforts were instrumental in the introduction, between 1900 and 1904, of legislation for the provision of free quinine to the poor and workers in malarial areas. Architectural solutions were, in the end, only a solution for the rich. Drugs took care of the rest. This was a theme that would acquire explicitly racial overtones when applied to workers’ housing in the building of the Panama Canal.

Personal Prophylaxis and Racial Privilege

Tropical medicine was closely aligned with the creation of new ways of moving about the world. The Italian experiments in malaria protection were premised on the expansion of railways into malarious regions, as indeed were many of the colonial maritime projects of European imperial powers. Yet no project at this time came close in scale, ambition or danger to the completion of the Panama Canal between 1904 and 1913. After the disastrous experience of the French in trying to construct the canal, during which 20,000 people lost their lives, American sanitarians lobbied for additional measures to protect workers. They took the attitude that all breeding spaces of the mosquito had to be destroyed and proper sanitation provided for employees “of every race and class”.

78 Cantani and de Marinis, “Celli, Angelo”
To the outside world, such sanitary measures demonstrated both the power of science and the power of military governance. Sir Ronald Ross wryly remarked that the Panama Canal was “being dug with a microscope”, while the editor of The Times envied the authoritarian streak of the Canal Zone’s governors: “Panama”, he noted, “has been purified by a benevolent despotism”. Few mentioned the trenchant racial divisions in the pay and comfort of the workers. Indeed the impression was of a tropical utopia, where white men and their families could prosper with scarce mention that two-thirds of the workforce were black West Indian labourers, paid half the rate of their European and American colleagues, and offered such poor housing conditions that 80% of them preferred to fend for themselves in makeshift shacks in the jungle or tenement housing in the nearby cities.

On the face of it, with the medical department headed by Colonel William C. Gorgas, who had overseen the eradication of yellow fever in Havana in 1902, one would expect to see measures put in place to eradicate mosquitoes and prevent their ingress into buildings. Indeed this was true. The existing towns around the Canal Zone were provided with running water. The buildings of Panama City and Colón were all fumigated, their cisterns and cesspools inspected and oiled on a regular basis while Anopheles Brigades were dispatched to dig ditches and clear the area around buildings to control the mosquitoes’ breeding. From 1906, almost all of the Isthmian Canal Commission’s buildings were screened. Screening was one of the distinguishing features of housing in Panama. It was not endorsed, however, by the Commission’s first chief architect M.O. Johnson who, in 1904, considered it a distraction from the more important work of building the canal itself. In a cruel twist of fate, Johnson

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81 Malcolm Watson, *The Prevention of Malaria in the Federated Malay States: A Record of Twenty Years' Progress*, (London: John Murray, 1921), x.

82 Editorial, "Health Work in Panama," *The Times*, Friday, September 20, 1912.

83 In mid 1907 there were 19,585 West Indian labourers and 4,317 European labourers at work, with approximately 6,000 Americans in clerical positions in January 1908. West Indian labourers received 10 cents an hour while Europeans were paid 20 cents per hour. Figures from Vaughan Cornish, *The Panama Canal and its Makers* (London: T. Fisher Unwin, 1909), 106-12. On racial discrimination of West Indian labourers in Panama see McCullough, *The Path Between the Seas: The Creation of the Panama Canal (1870-1914)*, 577-78.
contracted Yellow Fever and died in early 1905.  

For Gorgas, who devised the canal’s sanitary campaign, screening was of particular importance, especially early on:

Personally I lay great stress on screening. I would have it done always in the tropics. In early work, before mosquitoes are destroyed, screening is a great help. We are never sure enough of the disappearance of the mosquitoes to do away with screening. It is much preferable to live in screened houses than to be constantly taking prophylactic or malarial treatment. Of course there will always be cases of malaria now and then, even in the best protected places.

As a preventative measure, Gorgas therefore favoured screening over quinine, in contrast to German physicians like Robert Koch. Yet even though the Isthmian Canal Commission provided screened housing for all employees, few West Indians availed themselves of it. In part this was due to the basic conditions on offer; more importantly, however, the Commission provided little in the way of housing for the wives and children of West Indian labourers, unlike their white American employees. When they did provide houses, they were unscreened.

84 McCullough, The Path Between the Seas: The Creation of the Panama Canal (1870-1914), 451.
86 On use of quinine and Koch’s promotion of it see Neill, Networks in Tropical Medicine, 89-92.
Panama is a prime example of how decisions about domestic comfort and sanitation were racialised during this period. For the most part, regardless of race, workers were protected from tropical disease but access to more costly preventative measures depended as much on the colour of one’s skin as the skill of one’s labour. Segregation was expressed through pay, with unskilled workers paid in Panamanian silver and skilled workers in gold. Whether one was paid in silver or gold determined what schools your children could go to, the facilities you could access, the amount of holidays to which you were entitled and the range of housing on offer. As most of the unskilled workers were black West Indians and the skilled workers were white Americans, the gold and silver payroll system was, in effect, an unofficial means of drawing the colour line among the workforce.\(^{87}\)

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\(^{87}\) McCullough, *The Path Between the Seas*, 472. It has already been noted that Europeans made up 20% of the unskilled labour force but were paid twice the rate of West Indians for the same work.
Housing for skilled white employees (figs. 1.5, 1.6) was finely stratified by rank, marital status and wage. There was separate accommodation for married employees and bachelors, with couples sometimes accommodated in apartment quarters and, for the best paid, in single-family homes. These weatherboard buildings were raised off the ground for better cooling and to prevent the incursion of white ants.\(^8\) The houses were painted grey on the outside and white on the inside.\(^9\) All houses were furnished for free, with windows, verandahs and most beds screened. Those on higher wages were offered better accommodation at the rate of one square foot for every dollar earned, and further allowances were made for wives and children.\(^{10}\) The simplest accommodation for unmarried skilled workers consisted of shared bedrooms with screened-in verandahs (fig. 1.7). Nonetheless, this was considerably better than the housing available to the unskilled worker.

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\(^{9}\) McCullough, *The Path Between the Seas*, 479.

\(^{10}\) McCullough, *The Path Between the Seas*, 478.
Unskilled workers, known as ‘silver roll’ employees, as they were paid in silver, were given only the most basic accommodation—a raised, timber-framed bunkhouse with galvanised iron roofing supported by coffered trusses (Figure 1.8). This arrangement permitted air to circulate at the underside of the eaves. A gap between the roof and walls screened against mosquitoes. Bunks were crammed as closely together as possible and consisted of metal framed fold-down canvas beds, packed three-high. Often labourers were housed in screened-in box-carts that could be shunted along the canal railway to where work was needed. Not surprisingly, living in such cramped conditions, many West Indians suffered from pneumonia. Consequently few black employees stayed in the accommodation provided by the Isthmian Canal Commission, with some fending for themselves in makeshift accommodation.
in the forest and others living in cheap rented accommodation, one family to a room, in Colon or Panama City.  

Figure 1.8.  Labourers’ Barrack Accommodation Source: Avery, America’s Triumph at Panama,107.

The Commission would not screen silver roll married labourers’ housing as they did not wish to spend money on West Indian family members.  

This was in stark contrast to its treatment of American employees, for whom everything was done to encourage workers to live with their families. Yet protection was provided by other means. As West Indian workers built shacks on the edge of each station, Sanitary Department officials with the Commission decided to treat the area around the shacks with kerosene oil. Spraying stagnant water with oil was a common way to kill mosquito larvae. Normally the first 200 yards (183m) around a

91 McCullough, The Path Between the Seas, 577.

92 Watson, Rural Sanitation in the Tropics, 181.

93 Ross, The Prevention of Malaria, 60.
dwelling were cleared and oiled but the Department relied on a 500 yard (457m) radius for West Indian settlements. When in 1909 these workers and their families were found to have maintained low rates of malaria, the oiling was deemed sufficient and any architectural intervention ceased.

The case of Panama shows that governments were willing to adjust their treatment of building fabric to account for changes in the mosquito-malaria hypothesis. In the case of preventative screening, it is revealing that Celli’s ideas could travel to Central America as soon as 1904 and that others in turn could learn from the Panamanian experience. Indeed, the Anglo-Malayan surgeon, Malcolm Watson, relied heavily on his visit to Panama to illustrate his book *Rural Sanitation in the Tropics*, evidence that the Canal had an influence throughout the tropical world. However the experience of its workers also shows that, where other cheaper options were available for less valued members of society, screening was one of the first things to go. Architecture was not the only measure available to combat malaria, but it had a very visible presence.

At the same time, it was the houses built for the well-paid American workforce that would become the face and image of Panamanian healthiness, a model of America’s civilising mission in the tropics and one that some doctors, such as Sir James Barrett in Australia, were keen to imitate. Not everyone was as enthusiastic as Barrett, however. In England, Sir Andrew Balfour of the Wellcome Bureau of Scientific Research would later note that screening was expensive and, though effective, restricted air flow and led to complaints of such houses being “cabined, cribbed, confined”. Screening seemed to reach its apotheosis in the first decade of the 20th century, an immediate visible solution to a disease threat that was not at all under control. Screening slowed rates of infection and thus bought doctors some time. As other options for controlling mosquitoes came into play, such as drainage and oiling schemes, the popularity of screening as an immediate retardant declined.

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Tropical medicine may have extended its gaze to consider the health of the poorest workers, but this gaze was selective and segregating.

Although the canal was mostly dug by West Indian employees, their housing, their conditions and their faces were mostly absent from the publicity and reports on Panamanian housing. Barrett makes no mention of them, while the Malaysian malariologist, Malcolm Watson glances over the fact that there were markedly different conditions for different groups, noting it more as fact than as anything unusual. Yet reliance on the most basic sanitary measures for black employees without recourse to the additional expense of mosquito screens also showed that screening could be as much about demonstrating to prized employees and their families, through tangible modifications, that their houses were safe. Where employees were cheap, in plentiful supply and little valued, authorities were content to keep them at a distance and spend as little as possible to maintain their health and productivity.

Sanitary Existenzminimum

From the construction of the Panama Canal, it is clear that, when failure of a project had grave political or commercial consequences, governments were willing to spend whatever it took to ensure that skilled workers were kept healthy and happy. For unskilled workers, however, the cost of healthcare measures was scrutinised more closely, with little regard for comfort. A similar pattern can be found in the anti-malarial work of Malcolm Watson97 in the

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97 John Field, "Watson, Sir Malcolm (1873–1955)" in Oxford Dictionary of National Biography (Oxford: Oxford University Press, 2004). Sir Malcolm Watson (1873-1955) was a Scottish-born malariologist who studied medicine and arts at the University of Glasgow, gaining an MD from there in 1903. He also obtained a diploma of Public Health from University College, London in 1900 after which he joined the Malayan medical service where, from the start, he developed an interest in the prevention of malaria. An early follower of Sir Ronald Ross, Watson sought to control malaria through better understanding the habitats of mosquitoes and finding ways to limit their breeding with targeted measures adapted to individual species. While controversial, this approach soon spread to other parts of the world. He left his government position in 1907 to assist rubber planters expand into malarious regions, thus greatly aiding the expansion of the rubber industry. Watson's knowledge of malaria control was much sought after around the world and he advised governments throughout Asia, Africa, Europe and South America. A close ally of Ross, he departed Malaya for London in 1928 to head
Federated Malay States. Scottish-born and trained in Glasgow and London, Watson took an early interest in malaria control when he joined the Malayan medical service in 1900. With a limited budget he worked for private planters as well as the government. Watson was most concerned about how his anti-malarial measures would increase the productivity of workers. As in Panama, Watson experimented with quinine, screening and drainage. His efforts reveal the short and long-term economic calculations at play when doctors had to choose between pharmacological, architectural and engineering solutions. Such calculations were most concerned with the effective management of populations to minimise lost productivity due to illness. There was little concern for the well-being of workers and their families.

Watson gained early attention in the medical world for his drainage schemes in the town of Klang (1901-5) and its port, Port Swettenham (1901-5), in the State of Selangor, in what was then the Federated Malayan States. Aware of the anti-malarial work of Ross, Manson, Grassi and Koch who advocated drainage (Ross), screening (Manson and Grassi) and quinine (Grassi and Koch), Watson favoured Ross’s approach. At Klang and Port Swettenham he proposed to combat malaria by draining and filling marshland around the town. He reasoned that:

The active co-operation of the native community could not be expected and active resistance especially from the Chinese, was certain if any attempt were made to enforce the use of quinine. An enforcement of mosquito nets was, of course, impossible, since this would have meant constant house visitation at night. Compulsory screening of the whole of all the houses was impossible for financial reasons. The large acreage of swamp, the heavy rainfall and the amount of supervision required, apart from its cost and temporary efficacy, prohibited the use of petrol.98

Watson’s argument against other modes of prevention showed the colonial suspicion of indigenous and indentured populations. To doctors like Watson, they were not to be trusted to take quinine and required supervision when oiling swamps. Screening, the other option, was not worth the cost.

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Ronald Ross made a similar argument in 1907 regarding his work in West Africa, drawing a colour line between European and tropical solutions. Race was framed in social rather than biological terms. To Ross, like Watson, the ‘racial character’ of tropical populations was an obstacle to technology transfer, one where doctors’ dictates were resisted by all sections of colonial society:

The problem in malarious British colonies, which are mostly tropical and inhabited by dark races, is not the same as in Italy - a fact which is often forgotten by academical sanitarians. Such races cannot easily be persuaded to submit to continued medication by quinine and are much too poor to provide screens for their houses, and even Europeans in the tropics frequently reject both measures with obstinacy. On the other hand, drainage- prophylaxis demands no such compliance from the public.99

Watson’s preference for drainage was not just a question of avoiding problems of supervision and compliance. It was also one of cost. He estimated that, up to 1905, the total cost of the drainage and maintenance at Klang and Port Swettenham came to £1 4s per head of population.100 In comparison, quinine measures would cost £1 18s per head of population over ten years, a difference of 60%.101 He advocated the use of quinine in rural areas and also to treat the infected. He preferred drainage over quinine, however, as he considered drainage a permanent solution and one that could be better financed as a form of capital works:

Whether quinine be supplied free by a Government, or sold at cost price, or at a loss to the Government, a price is being paid, and the people are practically being assessed an amount which, however small, would still have paid the interest on a loan for a radical drainage work. Perhaps the work would only be a small one, but no matter, for it would definitely and for all time, if upkept, place the inhabitants beyond the reach of the disease.102

Despite his preference for drainage schemes, Watson also experimented with screening solutions, trialling them at a hospital in Jeram in 1902 and spending £240 screening an estate


100 Ross, "An Address on the Prevention of Malaria in British Possessions, Egypt, and Parts of America," 882.

101 Watson claimed that 10 grains of quinine given to 1000 people over 10 years would involve an outlay of £1,900. Watson, *The Prevention of Malaria*, 101.

in Selangor in 1904. Watson thought it worth trying as he believed that in Panama it had been screening rather than drainage that had kept malaria and yellow fever at bay. Despite varied views on their permanent efficacy against the spread of malaria, screens were nonetheless widely favoured as a temporary solution in the early 1900s. At that time, it was not known how long it would take for drainage schemes to effectively stop mosquitoes from breeding.

Although aware of developments abroad, Watson claimed to have based his solutions on the circumstances to hand rather than blindly copying approaches from elsewhere. Still, his experiment with screening adopted a similar rationale to that of Manson and Low in Italy. This, however, proved to be a brutal exercise of power. In Italy, test subjects were willing researchers, but in the Federated States of Malaya Watson experimented with indentured labourers who had little say in the matter.

He tested screening in ‘coolie lines’—long houses on plantation estates that accommodated indentured labourers and their families in cramped conditions. He tested the effects of housing indentured labourers in mosquito-proofed lines deliberately located in the most malarious parts of a number of plantations. Watson’s rationale was brutal: a risky search for a sanitary existenzminimum.

I chose the most unhealthy spot I knew. The object of the experiment was, of course, not to test the mosquito theorem, but to discover whether lines could be built which would be sufficiently mosquito proof to reduce malaria and yet would be acceptable to the ignorant coolie and in which he would be willing to live. Only one line was ever built, located in a Selangor estate alongside two ravines. One was drained but still contained malarious mosquitoes; the other was untouched jungle. The results

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107 Watson in his numerous accounts of the experiments does not state exactly where in Selangor the estate was. He did note, though, in 1915 that when he returned to the estate the lines had been abandoned. Watson, *Rural Sanitation in the Tropics*, 107.
were devastating. The first set of coolies sent to live there died of malaria and all of their children contracted the disease. Two contractors and many coolies died in the process of building the lines. Watson blamed them for not taking quinine. Still when a new set of coolies were brought to the estate and forced to live there, they did not receive any quinine. Watson thus could monitor the effectiveness of the screens as a form of prevention, without the question of the variable use of quinine clouding his results. The inhabitants of the lines were terrified. One complained of hearing a devil knocking on the walls. ¹⁰⁸ Many snuck out at night, preferring to sleep in unprotected lines than in their screened building.

Sleeping in a malarious zone was not only a psychological nightmare, it was a physical one also. Although the screens indeed stopped mosquitoes from entering, the buildings were unspeakably hot. The mosquito-proofed lines were more enclosed than other buildings and it seems there was little consideration for labourers' comfort. The high-pitched palm leaf roof which swept down to below head height was enclosed with a wooden ceiling. An image of the building (fig. 1.9) shows that most of the walls were boarded up, limiting the effectiveness of any ventilation. Watson himself noted that it was hot inside or, as he put it, ‘close’.

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¹⁰⁸ Watson, The Prevention of Malaria in the Federated Malay States, 121.
Watson’s incessant experimenting with different methods and monitoring of populations allowed him to determine the relative cost and benefits of each method. Yet it also shows us how much experimentation took place through coercion. Any resistance was put down to ignorance or bad management. Watson did not seem unduly bothered that in some cases he placed his test subjects in extreme danger. His attempts to expand the use of screening in ‘coolie lines’ were set up to provide evidence for an extreme case. If the screening could work there, it would be effective anywhere.

Forced to live in a highly malarious location, in hot, poorly ventilated buildings, many of the indentured labourers caught the disease and died. Watson’s screening experiments show that, in the early 20th century, tropical hygiene did not always consider the comfort of occupants; in extreme cases, this could have devastating consequences. Yet it also reveals the resistance of occupants to building interventions when there was evidently little regard for their physical or psychological welfare.
The discomfort forced on those who were subject to Watson’s experiments was such that labourers preferred to risk contracting malaria than to sleep inside.\textsuperscript{109} Some ventured out to other unprotected lines to sleep at night, while others slept outside in a blanket. Watson never saw his experiment through to completion, not because his faith in it was compromised, but because he himself was in poor health.\textsuperscript{110} Besides, he had since found that drainage schemes could prevent malaria far sooner than he had once believed. Yet the question of how to protect and house temporary workers with a modicum of comfort continued to tax practitioners of tropical medicine well into the 1920s.

Medical Retrofit and Colonial Domesticity

Ideas about malaria prevention travelled through and across Imperial networks, aided by guidebooks, textbooks, journals and the new schools of tropical medicine. Many of the doctors associated with these schools tried their luck at publishing popular guidebooks intended for first-time visitors to the tropics. While directed at civil servants, clergy, the military and their families, the guidebooks allow us to see how doctors imagined tropical domesticity. In their practical advice to newcomers to the tropics, they reveal the expected social hierarchy of the tropical sojourner and some of the complexities and contradictions that new medical technologies introduced. In the first decade of the 20\textsuperscript{th} century, few guidebooks gave much information on the housing standards for servants, but by the following decade, detailed recommendations were provided.

The example, again, of the screened house shows how Italian ideas on screening made their way into British medical textbooks. It also demonstrates the added complexity the new screening technologies created for teaching and living in the tropics. As well as this, the new theory of tropical medicine, with its focus on controlling contagious disease, advocated and later gave cover to the implementation of strict racial segregation in colonial cities.

\textsuperscript{109} Watson describes the resistance by indentured labourers to the lines in some detail and with mild consternation. See Watson, \textit{Rural Sanitation in the Tropics}, 120-21.

\textsuperscript{110} Watson does not specify what illness he was suffering from. See also Watson, \textit{The Prevention of Malaria}, 120.
New popular guidebooks on tropical hygiene heroically documented the pioneering exploits of Celli and Manson. Both W.J.R. Simpson, Manson’s colleague at the London School of Tropical Medicine, and G.M. Giles, recently retired from the Indian Medical Service, included illustrations of Celli’s work, with Simpson also describing the British experiment in Italy. The Italian grass-huts startled Giles who considered them “not a whit in advance of the savages of Central Africa” and their inhabitants to be the least likely to adopt new technology. Yet when Giles went to see them for himself, the enthusiasm that the peasantry and railway workers showed for Celli’s adaptations demonstrated their effectiveness.

Initially the mesh screen appeared to be simply a practical way to protect openings from flies while still allowing the air to flow through. Yet people still had to enter and leave the screened environments and doctors fretted over how best to control access to these animal-free spaces. Though Celli had demonstrated the practicality of spring-loaded doors and screened entrance porches, Giles argued that the tropical bungalow presented a separate but not unsurmountable challenge. Each room of many bungalows had more than one door opening to the outside. Giles noted that Celli’s spring-loaded doors were more expensive than ordinary doors, hence the number of doors on a typical tropical house needed to be dramatically reduced for economic reasons. “Though desirable and even necessary for free ventilation,” he contended, “no room can possibly require more than a single door opening on the outside, and in a well-planned house with suitable corridors, there is no real necessity for more than one or two exterior doors to the whole house.” Ventilation and mosquito-proofing were thus put in conflict, and their reconciliation required a reconfiguration of the building envelope. To solve the problem, Giles recommended making wall openings as windows rather than doors and reducing the number of external doorways to the absolute minimum. In addition, echoing Celli’s lifestyle argument for his gabinetto, he proposed that


112 Giles, Climate and Health in Hot Countries, 118.

113 Giles, Climate and Health in Hot Countries, 118.

114 Giles, Climate and Health in Hot Countries, 119.
“a considerable area of verandah should be included within the protected area, as a good deal of time is necessarily most pleasantly spent in the verandah, not only in the evening but during the rains throughout the day”\textsuperscript{115} The mosquito screen would protect the many perceived advantages of the verandah and render it healthy once more.

Figure 1.10. Giles' adaptation of Celli's system of mosquito-proofing for an existing Indian bungalow \textit{Source:} Giles, \textit{Climate and Health in Hot Countries}, 121.

\textsuperscript{115} Giles, \textit{Climate and Health in Hot Countries}, 120.
Giles showcased the feasibility of Celli’s adaptations, by illustrating how to reconfigure “an existing up-country Indian Bungalow” (fig. 1.10). The main verandah was gauzed in, with a double swing-door placed to one side. Two separate double-swing doors were located by the hall entrance and on the rear verandah that communicated with the dining room. The four small bathrooms, located at each corner of the house, also had their own single spring-loaded door while entry and exits between all other rooms’ doors to the side and rear verandahs were gauzed in, redirecting movement in the house through to the main reception rooms. Giles was less worried about the bathrooms as he claimed they were rarely used, instead drawing readers’ attention to how he had reduced the number of entrances to just three. What is also noteworthy is that, formally speaking—and unlike Celli’s boxy additions—Giles’ adaptations did not extend beyond the existing building envelope. The movement of occupants was instead reconfigured, protecting certain transition spaces and rendering others useless.

Giles noted the advantages of mosquito-proofing, which meant that people could live and work in malarious districts without depending on their neighbours to maintain a given level of sanitation. He acknowledged, though, that the additional expense of screening was not justified in every instance. He drew a distinction, for example, between native and non-native officers. He argued that the Government had a duty to protect all forestry and irrigation officials and should step in to screen all military barracks. Those who rented from landlords, however, “who are generally needy natives, with neither inclination, nor means, to provide costly improvements”, were better served by portable protection for just their bedrooms.

116 Giles, *Climate and Health in Hot Countries*, 121.

117 Giles, *Climate and Health in Hot Countries*, 122.

118 Giles, *Climate and Health in Hot Countries*, 122.
As the risk of malaria was considered most elevated at night, particular attention was given to screening beds (fig. 1.11). Simpson described a ‘mosquito house’ to be placed around the bed, consisting of fine mesh stretched over a wooden-frame, with a spring-loaded door for entry and exit. It was considered preferable to calico mosquito curtains, suspended over the beds, due to the risk of “arms during sleep, perhaps coming in contact to the curtain”.\textsuperscript{119} Giles thought portable mosquito screens were preferable to Simpson’s mosquito rooms. He argued that, as most windows and doors in India were of a standard dimension, the portable screens would work in most instances and a complete set for a family would “weigh far less than an average piano, and be far more conductive to health”.\textsuperscript{120} In another instance of the potential conflict between air movement and screening, Giles also justified the use of portable screens as they still allowed a punkah to operate in the room without interference. It is unclear

\textsuperscript{119} Simpson, \textit{The Maintenance of Health in the Tropics}, 60.

\textsuperscript{120} Giles, \textit{Climate and Health in Hot Countries}, 123.
whether anyone developed Giles’s proposal for portable screens, or was willing to give up their piano, when calico screens were also available.

The realisation that malaria was contagious and that those infected with it, even when they displayed no symptoms, could pass on the parasite, became a pretext for further segregation of Europeans from indigenous peoples. Without giving any supporting evidence, Simpson claimed that ‘native’ children were risky and that European residences had, therefore, to be firmly separated from ‘native housing’, with servants quarters kept at a suitable distance. Simpson’s list of principles of tropical housing were shared by a wide range of publications on tropical living for guidance for women moving to India to engineer’s reports on tropical housing to text books for sanitary inspectors. 121 Tropical hygiene did not attract the same kudos among the scientific community as the discovery of new parasites, but Simpson was one of its primary advocates in the London School of Tropical Medicine. Despite Watson’s trials with mosquito screening, in the end he placed less faith in the screens to reduce the risk of malarial infection and more in eliminating mosquito populations as its principal vector, thus separating Europeans from any contagious risks.

It is worth noting how doctors progressively increased the number of locations around the house that were to be modified and screened to prevent the entrance of any vermin. The mosquito screen was not the only adjustment that doctors recommended to the design of the tropical house in these years. Doctors also focused on eliminating any potential breeding spots for mosquitoes as a factor impacting on health and domestic comfort that went well beyond questions of architectural modification. Mosquitoes were known to breed in shallow pools of water and, while mid-19th century medical experts had advised tropical residents to avoid marshes and damp environments, by the early 20th century it was clear that every puddle, every tank and every gutter was a potential threat.

All tanks and gutters were, therefore, to be screened and sites well drained. Doctors in Sierra Leone even went to the extent of proposing a gutterless verandah, which was widely published. Verandahs were expected to be deeper—not just to provide shade, as before, but also to project water ever further from the house and eliminate the need for guttering. Such devices were scrutinised for risks of ponding, both in the exterior fabric of the house and in its immediate vicinity.

The increased scrutiny of building design to the risks of vermin is further demonstrated in the revisions Simpson made to the chapter dealing with dwelling houses in his seminal publication on tropical hygiene. In the first edition, published in 1905, he outlined his general principles for housing design. At that time, the state of knowledge about climatic design of dwellings had changed little in 50 years. Like Moore before him, Simpson recommended raising bedrooms well off the ground, avoiding the damp earth and using double roofs and double ceilings to keep the interior cool. Simpson was aware of the risks that mosquitoes posed, placing most emphasis on avoiding risks of malaria infection through screening, drainage, fumigation of infected houses and segregation of Europeans from both their servants and their (native) dwellings. He recommended that each house should have a well-constructed system of drainage and a surround of gravel to keep snakes at bay; that verandahs and water tank inlets and outlets be screened, and care taken with the disposal of household waste to avoid ponding. The only technical conflict he highlighted between keeping a house cool and preventing infection was that thatch or grass roofs, while cooling, could harbour vermin.122

Yet by his second, 1916, edition, Simpson presented a more detailed risk analysis of specific building technologies and vegetation while also increasing the number of claims made regarding the supposed health risk of native servants. While he noted the advantage of double roofs for keeping a house cool he also advised that “the air space should, however, have communications with the outer air, so as to secure good ventilation, but these openings should be protected by wire gauze, to prevent the entrance of rats, bats and snakes”.123


Verandahs and roofs were not the only part of the house to be screened, but also the doors and windows to bathrooms. Water tanks were to be further protected from mosquitoes, with a screen over the lid as well as over the inlet and overflow pipes.124 Completing the picture, outside the house, bamboo and banana trees were now alleged to be a home for mosquitoes and should never be planted close to dwellings.125 Although, 50 years previously, Moore made no mention of vermin, by the time Simpson wrote and revised his guidebook, flies, bats, rats and snakes were all to be designed out of the home. As a new way of seeing the world, technologies like thatch and double roofs that were accepted as normal or even innovative by Moore had been refuted or refined due to the fear of infection.

Reimagining Climate

With the help of the laboratory, tropical medicine shifted from climatic to biological explanations for disease. That did not mean, however, that climate lost its grip on the medical imagination. As tropical diseases were identified and new ways of controlling them proposed, the short-term health of European sojourners seemed increasingly assured. Yet whether Europeans could settle long-term in the tropics without any ill-effects remained a question that taxed the medical profession.

A variety of stances were assumed. Malariologists such as William Gorgas believed that the American experience in Panama showed that there was no limit to where white people could live and that in the future the tropics would become centres of white civilisation.126 It was simply a question of adequate sanitation. Others, such as the U.S. Army surgeon Major Charles E. Woodruff, thought otherwise. In his influential 1905 book The Effects of Tropical Light on White Men, Woodruff drew on his experience in the Philippines to argue that Europeans had no natural defences against tropical conditions. Far from their

‘zone’, he believed them to be heavily reliant on artificial environments and technologies for protection.

The data already show that, in regard to pigmentation, acclimatization is impossible if one goes far from his zone, and, when we apply the same reasoning to every other character which has been developed for one particular zone, we can understand the reason for the anthropological and biological law that every living thing must remain in its zone to survive permanently, and, if it is taken out of its zone it must be surrounded by artificial conditions which approximate its natural environment, or must hide from the dangers against which it has no natural defence.  

For Woodruff, light was a stimulant akin to alcohol. It was Europeans’ pigmentation that was to blame for their problems in the tropics. An excess of light in the tropics with such pale skin was the reason for many colonial officials and their wives suffering nervous breakdowns. Other experts like W.J.R. Simpson favoured disease control but continued to promote older beliefs that high temperature and humidity stressed the European constitution.

At the heart of the matter was the question of whether the long-term acclimatisation of Europeans was possible once tropical diseases were controlled. Those at the forefront of disease control like Gorgas were optimistic, but Woodruff and his followers were sceptical—among them Sir Havelock Charles, Surgeon-General to King George V, and Sir Andrew Balfour, Director-in-Chief of the Wellcome Bureau of Scientific Research in London. Some, like Balfour, were also swayed by a wave of geographical publications that held that the rise


and fall of past civilisations was largely due to historical climate change. For sceptics only the fittest, most even-tempered of men were thought suitable for tropical life. Yet that appeared to rule out many candidates, among them women and children, without the use of additional protective measures.

Older methods of dealing with climate continued to hold social value, even when their medical justification seemed obsolete. Hill towns, as noted above, had been a means for the military to avoid malaria, but were reimagined in the early 20th century as health resorts and a protective refuge for women and children from risks of contagion. Indeed, as David Pomfret has noted, the expansion of public health to indigenous populations did not put an end to older ‘enclavist’ models, but “stimulated new engagements with the older technology of the hill station enclave”. Similarly, when we examine the case of the tropical house, antimalarial measures at the turn of the 20th century did not put an end to medical interest in ventilation, orientation and the provision of comfort in the home. Instead, textbooks on tropical hygiene, journal articles and research reports continued to include sections on ‘Housing for Europeans’. These sections placed great emphasis on the need for comfortable dwellings as either a means to prevent alcoholism and nervous disorders or to make mosquito screening acceptable.

Writing in 1909 from Togo, the German physician Claus Schilling, in his textbook *Tropenhygiene*, reasoned that comfortable homes would keep colonists away from their clubhouse and inn. While he acknowledged the social and sporting roles of clubs, he was less tolerant of the colonial drinking culture. Andrew Balfour made a similar argument in Byam’s and Archibald’s popular manual on the *Practice of Medicine in the Tropics*. Both

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133 Pomfret, ""Beyond Risk of Contagion," 85.


Schilling and Balfour went into considerable detail about how best to site buildings, including materials options and wall and roof constructions that promoted cooling. Overall, though, the bungalow continued to be the main model for tropical housing. Building design was largely reduced to questions of ventilation and shading and much of the advice was similar to that offered by 19th century physicians like W.J. Moore, who we came across in the first part of this chapter—outmoded in medical terms, but now ingrained in the colonial experience.

The main difference, however, across the span of time punctuated by the validation of the insect vector theory was the much higher degree of attention now being paid to the task of keeping animals and insects away from the interior. Balfour included an example of a “bat-proof dwelling” and at every opportunity reminded his readers of the need to screen openings, not only with the large mosquito screens used in Panama but also in securing the gaps between double walls and double roofs against animals of all sizes. Yet, as we have seen, the early screened buildings in Panama and Malaysia, particularly those for indentured labourers, restricted airflow and often were so hot that occupants preferred to risk getting bitten rather than sleep inside. Among those doctors who attempted to make screened housing more comfortable, the most noteworthy was T.F.G. Mayer, a doctor in the West African Medical Staff, who proposed his own design for a prefabricated screened hut for the tropics (fig. 1.12).137

136 Balfour, “Habitations and their Annexes,” 44.

In many ways, this was the logical development of Manson’s and Low’s Italian hut considered above. The two designs even shared the same fabricator, Humphreys & Co. of Knightsbridge in London. Both had a shallow pitched roof with large overhanging eaves. Mayer’s solution, however, reduced the house to no more than a roof with gauzed walls to stop mosquitoes from entering. He left it up to occupants to decide on how they wished to subdivide the interior space to maintain a modicum of privacy. The design was supposed to be adaptable to allow multi-storey construction and a range of foundation systems. Mayer’s illustration showed the house set on flat ground with five palm trees swaying behind. Two wispy figures languished in the background, one white, one black, wondering perhaps how to flee from the sparse landscape. Despite the building’s permeability to wind, his drawing offered no visual clues about the interior. The house was a medical device, not a place for relaxing.

Doctors continued to advocate all-round shading of buildings, but for psychological as well as physiological reasons. Sunlight and high temperatures continued to be blamed as the
principal causes of nervous breakdowns or ‘tropical neurasthenia’. Woodruff’s argument that light over-stimulated people was taken seriously by both metropolitan critics such as Havelock Charles and doctors and engineers in the field like Balfour and McLean.\textsuperscript{138} Charles used it as evidence of the impossibility of tropical acclimisation.\textsuperscript{139} Engineers like the Scottish-born McLean, who in 1908 was based in Khartoum along with Balfour, relied on Woodruff to justify his solutions. McLean was asked by Balfour in 1908 to write about building in the tropics and made liberal reference to the work of Woodruff and W.J.R. Simpson.

If housing had to be built in the tropics, then for Woodruff and his followers, it ought to be as dark in its interior and shaded exterior as possible:

The roof of a porch or veranda must come down so low that a person seated in the room cannot see the sky; that is the lower edge must be about four feet above the floor line, or appropriate screens be built to that level.\textsuperscript{140}

In his house in Khartoum (Figure 1.13), McLean did not follow such impractical advice. The awning, placed at 2.3m above floor level, was well above the recommended four feet (1.2m) in height. A low verandah would have greatly restricted views out and only children could move through them.

\textsuperscript{138} McLean, “Dwelling Houses in the Tropics,” 68.

\textsuperscript{139} Charles, "Neurasthenia, and its Bearing on the Decay of Northern Peoples in India." 6.

\textsuperscript{140} Woodruff, \textit{The Effects of Tropical Light on White Men}, 328.
While Schilling did not refer to neurasthenia, he, too, showed how awnings could be sized for most general orientations and latitudes within the tropics (fig. 1.14). The diagrams explain the varying positions of the sun relative to the façade at key points across the year and at different latitudes in the tropics.
Only in rare instances did doctors challenge the orthodox view that the bungalow was the ideal tropical house. Most continued to be ambivalent towards the vernacular craft demonstrated in indigenous constructions. In some instances, as for Charles Woodruff, the
dark dwellings of local people in the Philippines were regarded as sensible. For others, such as Schilling, such darkness was evidence of filth.\textsuperscript{141}

Perhaps the main challenge to the orthodoxy of the bungalow came from the legacy of the Spanish Empire in the wake of American possession of many former colonies. A number of American doctors, like Woodruff, wanted nothing to do with the older Spanish way of constructing buildings, arguing that the excess of light in the Spanish types caused glare and, hence, ill health. On the other hand, defenders of the tradition, like Cuban public health reformer Juan Guiteras, believed that “the expansionists of the Anglo-Saxon, Teutonic and other European families” could learn much from studying the Spanish experience of colonising the tropics.\textsuperscript{142} While he admitted to an American audience that the Spanish paid little attention to tropical hygiene at the end of the 19\textsuperscript{th} century, he argued that Spain’s earlier ‘success’ in settling the New World owed much to the lifestyle they adopted—borrowing from the building traditions of those they colonised, and importing others from one part of the globe to another as seemed necessary. Chief among these translations was that of Moorish building traditions, taken from Andalusia to be recalled in the tropics:

He defended himself against the heat by shutting himself up; he was afraid of the air, especially the night air, but this fear did not possess the Englishman. The Spaniard erected spacious structures with thick walls and large openings for doors and windows, but these were always kept closed, excepting some small wickets.\textsuperscript{143} Guiteras’s observation about the closure of windows and doors to ward off night air mirrored Sambon’s and Low’s note from 1901 about similar practices in Rome.\textsuperscript{144} Indeed Guiteras’s presentation of an alternative tradition of tropical architecture offered another way of evaluating new proposals. Consequently, as we shall see in Chapter 3, some doctors and architects were quite open to challenging the orthodoxy of the colonial bungalow.

\textsuperscript{141} Schilling, \textit{Tropenhygiene}, 48.

\textsuperscript{142} Juan Guiteras, "Reports “the White Race and the Tropics” by Dr J Guiteras [Read by Title at the Tenth Annual Meeting of the American Society of Tropical Medicine, Held at Washington, May 6,7 and 8, 1913],” 6. NAA SP1061/1 245. National Archives of Australia, Sydney.

\textsuperscript{143} Guiteras, “the White Race and the Tropics,” 6.

\textsuperscript{144} Sambon and Low, “Report on Two Experiments,” 521.
Conclusion

This chapter has shown how, in the early 20th century, doctors continued to debate and share knowledge about building in the tropics, addressing the immediate threat of malaria in response to shifts in scientific knowledge of its transmission and treatment, but also the broader issue of how European colonists and settlers could survive in the apparently hostile conditions of the tropics. Despite the changed understanding that many tropical diseases were parasitic rather than climatic in origin, housing was still expected to deal with the climate. Where once climatic design was a question of survival, in the early 20th century it gradually morphed into a question of comfort. Older designs were reframed as protecting European mental health and continuing to offer a good night’s sleep. The design of the tropical house recommended by doctors, architects and engineers across American, British and German colonial cultures was relatively similar, proof of a common culture of shared ideas, rather than inter-colonial rivalry in the domain of medicine and its interactions with the design of the tropical house.

Although tropical medicine did not greatly alter the form of the ‘tropical house’ that had developed in India in the 19th century, the interior of the house became an increasingly exclusive space, isolated from an exterior perceived to be hostile and uncomfortable. Climate still played a role in these discussions, but the prevention of disease and, with it, the exclusion of a far wider range of animals and insects, served to alter the internal circulation of dwellings and the detailing of the building envelope. Temperature and air movement were not the only criteria with which a building was judged. If anything, discourses of disease became used to further separate and segregate the rulers from the ruled despite the continued expectations of service.

Doctors training in tropical medicine were expected to know a little about the types of materials and siting considerations that might be appropriate for tropical locations. This advice was informed by rationales of comfort and sanitation. Yet textbooks had little detailed information about local building traditions or materials used in tropical locations. Instead text books like Archibald’s and Bynum’s Practice of Medicine in the Tropics compiled a range of plans, sections and images of houses to educate doctors, wherever they were posted, about possible solutions. The view therefore is one of an abstracted, universal architecture at the service of medicine, one with little grounding in any particular locale. At the same time, doctors were invested with the power to greatly alter the physical and biological landscape,
and this extended to houses. We saw in Malaya how a doctor like Watson could develop extensive urban and rural drainage systems, effectively ridding whole regions of mosquitoes. He could also gain government funds to test screening systems. We also saw how, when faced with an environmental problem, architecture was generally only one of a number of solutions. In the case of screening, architecture was chosen not as a long-term but as a medium-term solution to protect people before drainage schemes took effect. Yet, given the expense of building, this generally only occurred when a high value was placed on the welfare of the building’s occupants—a colonial privilege and, by extension, also a racial one. Doctors took a diagnostic approach to understanding building design but architects did not always heed their advice about sanitation. Architects could downplay its necessity, with sometimes devastating consequences, as we have seen in Panama. In some cases, doctors were confident enough to design houses, but others collaborated with engineers and architects. In the process, a fertile exchange between the design and medical professions came into being.

The question of acclimatisation and the long-term settlement of Europeans in the tropics was still a contentious issue by the second decade of the 20th century. Even though tropical medicine was increasingly confident it could control the effects of disease, many were uncertain of the long-term risks to Europeans of living in a tropical climate. The provision of comfort was generally a short-term tactic to attract skilled workers, as we have seen in Panama, and acted as a form of compensation for working in what many considered a dangerous environment. Most of the examples in this chapter were located in exploitation colonies, where Europeans were posted as part of a small colonial elite. Even in Panama, where large numbers of white Americans did go to work, the experiment was short-lived. Yet, for all the discussion of disease propagation and how architecture, town planning and medicine could protect populations, the prospect of European settlement was overshadowed by engrained views about the fundamental suitability of Europeans for long-term tropical life. These views, informed by 19th century understanding of the biological and cultural bases of human difference, empowered climatic theory to explain intergenerational changes in people’s physique and temperament. As we shall see in the next two chapters, these views and climatic theories determined the parameters of building in the tropics, and in the Australian north especially.
Rumblings abounded about the large-scale settlement of Europeans in northern Australia. The conditions of small tenant farmers and their families prompted anxiety among those in power about the white man’s place in the world. Undertaking physical work in the tropics and without a coterie of servants at home, they reopened long-settled debates about tropical acclimatisation. This would come to a head in the aftermath of the Federation of Australia in 1901.
Chapter 2 Defining Thermal Frontiers

The first chapter of this dissertation explored how medical discourses about disease transmission and climate shaped the architectural design and adaptation of tropical dwellings in the decades either side of the turn of the 20th century. These discourses substantially overlapped after the mid-19th century, such that the design of the house and its surrounds in response to climatic conditions was considered an important method of disease prevention, particularly for European officers. By the early part of the 20th century, however, discourses on climate and disease transmission began to separate. Many tropical diseases were found to have parasitic rather than climatic origins. Doctors became increasingly confident that, with suitable medical precautions, Europeans could work in almost any location in the world without risk of ill-health. This new understanding that diseases were transmitted by parasites informed a scale change in the way that ‘innovations’ in medicine shaped architecture and town planning—from screened houses to segregated cities. Yet earlier ideas about climatic design were culturally entrenched and did not go away. Instead, they were repackaged to make hostile locations seem more attractive. Still, lingering doubts remained about the long-term effects of warm climates on Europeans. This was especially so in Australia, where settlement of its vast tropical north became a pressing political issue after federation in 1901. Even with diseases under control, many within the medical profession doubted whether full acclimatisation—and, hence, settlement—was possible.

In Australia, the question of whether tropical acclimatisation carried any risks came to a head with the enactment of two pieces of federal legislation in 1901—the Immigration Restriction Act and the Pacific Island Labourers Act. The acts, which as noted above in the introductory chapter, together underpinned what became known as the ‘White Australia Policy’, were designed to draw a colour line around entry into the nation and deport those
who did not fit the newly federated nation’s self-image of a White Man’s Country.¹ Many of those targeted by the acts were labourers in the sugar industry, largely found in coastal Queensland. The consequence was that white Australians were expected to replace Pacific Island labourers, turning northern Australia into the setting for a racial experiment in tropical agriculture. Unlike other parts of the tropical world, white workers were expected to carry out physical labour in Australia, to populate and reproduce to ensure the continued viability and expansion of agricultural settlements.

Northern Australia contained few of the tropical diseases that concerned doctors elsewhere, with little evidence of malaria or yellow fever. This lack of disease again brought questions of climate to the fore, with doctors and geographers stepping in to provide guidance on how to best enable rational settlement that would minimise any climatic risks posed by permanent life in the tropics.

A key feature of these climatic debates was the question of not just whether but where white Australians could live and work productively in tropical Australia. Climatic surveys and weather charts took on particular significance as documents describing the limits of settlement—or of settlement under specific conditions. Isotherms—lines of equal temperature—came to represent not only a line of equal temperature on a map but also a physical boundary to white settlement, a ‘thermal frontier’. How were these thermal frontiers calculated, delineated, circulated and contested and how did these climatic maps ensure that climate remained controversial during the first major period of northern settlement in Australia?

This chapter explores how doctors and geographers developed thermal standards and climatic comparison methods to give the appearance that race-based settlement of northern Australia was rational, safe and could endure. It traces the use of graphic comparison to assert the relative deviance of a climate from a range defined by convention as acceptable for European habitation and the concerns this raised about the likely effects on productivity and wellbeing. By also examining the work of geographers, the chapter acknowledges the

interdisciplinary nature of climatic discourse at the turn of the 20th century. It pays particular attention to geography’s search for a unit of habitability in comparison to medicine’s search for a unit of comfort. This allows us to examine how climatic analysis was transformed and distorted by attempts to equate particular ranges of temperatures with particular rates of productivity. Many of the standards were developed outside Australia to improve the welfare of miners and weavers but ended up being applied to Australia to determine what parts of the country could be settled. By examining this translation of standards we can see how the impetus of settler colonialism transformed tools for managing industrial populations.

The chapter begins by describing how fears about tropical acclimatisation played out in the sugar-growing communities of northern Queensland and the attempts by metropolitan experts in tropical medicine to quell dissent over the impact of the tropical climate on the health of poor white workers and their families. It then considers how thermal standards developed from investigation of maximum exposure levels for workers in hot industries in England. The chapter traces the transformation of these standards into thermal frontiers—spatial boundaries informed by geography, medicine and politics—that defined the territorial limits for European settlement in Australia. It contrasts the development and application of these standards with analogous attempts by Australian geographers to determine acceptable climates for ‘white civilisation’ and synthesise a unit of habitability for agricultural settlement. The chapter suggests that many of the standards and graphic comparison methods facilitated remote decision-making about tropical climates and were the prototypes for a number of the bioclimatic design tools that would be developed after World War II.

A White-only Workforce in the Tropics

In May 1905, as federal members of parliament visited the sugar-growing districts of central and northern Queensland, local representatives of the cane-growing industry and public bodies in Mackay published a small pamphlet to acquaint their visitors with “the salient facts” of their district. The sugar manufacturing and cane-growing industry was threatened with “disastrous results” from the ending of the ‘sugar bonus’, which was supposed to incentivise a white-only workforce and make it less attractive to employ Pacific Island labour. The sugar bonus, which offered a government bounty of an additional 4s 8d per ton for white-only grown sugar, was due to come to an end in 1st January 1907, a day after the
termination of all labour agreements with Pacific Islanders under the Pacific Island Labourers Act of 1901.

Most of the discussions about the sugar industry in the pamphlet addressed the question of whether white men could replace Pacific Islander ‘boys’ in the growing and gathering of sugar cane. The question appeared largely one of economics and racial exploitation, to judge by the chapters on “The social development of a people of the district from the pioneer to the permanent farmer” and “The cost of growing cane by the farmer under white and Polynesian labour conditions”. The authors of these chapters measured the viability of the sugar industry in terms of the difference in wage rates of white and Polynesian labour, quantifying community ‘progress’ in terms of enhancing the status of white men and increasing the number of public buildings. For the local representatives, better status and more buildings meant that white labourers were more engaged politically, economically and socially. The wage inequity with Pacific Islanders seemed hardly to matter when they were seen to enjoy “conditions which would be envied by white labourers in many parts of the world.”

Although the pamphlet showed little sympathy for the welfare of the Pacific Islanders, who were evaluated only in terms of their economic cost and output, the continued physical and mental health of white labourers was questioned by Dr G.T. Lloyd in a short chapter offering “the opinions of a medical man after fifteen years’ residence and practice in Mackay”. Lloyd painted a picture of racial degeneration resulting from the combined effects of poverty and a tropical climate on settler fertility, stamina, parenting and mental health. He believed, in particular, that it was “impossible for the average white woman to lead a natural married life in the tropics without being broken down in body and in mind before the end of

2 Some Notes on the Town and District Of Mackay: Compiled for the Information of the Members of the Federal Parliamentary Party and for General Circulation (Mackay, Qld., 1905), 13,16.

3 Some Notes on the Town and District of Mackay, 14.

4 G.T. Lloyd, "The Medical Point of View: A Brief Summary of the Opinions of a Medical Man After Fifteen Years' Residence and Practice in Mackay," in Some Notes on the Town and District of Mackay (Mackay, Qld., 1905), 6-8.
child-bearing, unless in circumstances which enable her to leave occasionally for a more temperate climate.  

Without holidays, white settlers were doomed. Lloyd’s prescription of a climatic remedy for tropical ills was hardly novel. The supposed health-giving properties of fresh air, light and openness saw sanitoria built in alpine environments, whose tropical manifestation was the upland hill station such as those at Darjeeling or the Cameron Highlands in India and Malaysia (considered in the previous chapter). In Australia, under the influence of Indian models, similar health retreats and convalescent homes sprang up at the end of the 19th century in the cooler climates of the Blue Mountains near Sydney, Adelaide Hills near the South Australian capital and Toowoomba in Queensland. While the Australian hill stations were not as stratified by class as their Indian counterparts, they did largely cater to a middle and upper class clientele. Indeed, as Lloyd noted, such treatments were not affordable for everybody, particularly poor farming families.

Rather than considering the effect of the sugar bonus on the financial viability of the cane and sugar industry or the social status of labourers, Lloyd examined the medical outcomes of those workers who were unable to afford the technology and treatments to protect themselves from the climate. For Lloyd, quality of housing was a prime determinant of health; in the general adoption of iron as the cladding for housing, he saw evidence of poverty and the exacerbation of the effects of an already debilitating climate. “Few of those belonging to the poorer farmers or labouring men are ceiled,” he noted, “and in the greater part of the day they are little less than ovens”. According to the doctor, the physical stress of domestic work in such conditions was altering women’s bodies and further weakening their physical endurance. “Under these conditions”, Lloyd warned, “it is impossible that, except in extraordinary cases, they should retain the requisite amount of fat which Nature provides to White people in the climates to which they are indigenous, and the results are very sad”. To Lloyd, the exertion required in such an unnatural thermal environment threatened a woman’s role as a parent in two ways. First, physical fatigue left the housewife with no energy to

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5 Lloyd, ”The Medical Point of View;” 7.
6 James Beattie, ”Imperial Landscapes of Health: Place, Plants and People between India and Australia, 1800s–1900s,” Health and History 14, no. 1 (2012), 113.
supervise her children who, he claimed, risked contracting ankylostomiasis, or earth-eating disease, as they wandered unattended outside. Secondly, the strain of such a hard life was gradually making women infertile. “Few of the native-born women are free from uterine disorder,” the doctor cautioned, “after they have borne two or three children”. For Lloyd, white bodies were out of place and were being reshaped, even sterilised, by the heat and humidity that accompanied tropical housework.7

Lloyd’s identification of women and children as bearing the brunt of the effects of the weather introduced another set of actors into the Australian debate about long-term white settlement in the tropics. Indeed, across the tropical world, as David Pomfret notes, women and children were the focus of European anxieties about racial and cultural reproduction.8 Lloyd observed that men were unaware of the thermal conditions that their wives dealt with during the day due to their work commitments outside the home. The press paid most attention to Lloyd’s pronouncements on women and his report was heavily referenced three years later in a well-publicised speech in Melbourne by Mrs. T.D. Chataway to the Australian National Women’s league on the subject of “White Women in the Tropics”.9 In particular, she highlighted the supposedly deleterious effects of housing on women, the lack of servants and requests for the government to better fund settlement schemes.

While other authors in the 1905 pamphlet also noted the long hours that farmers worked, it is difficult to take Lloyd’s claim about male ignorance at face value. Did women really not communicate about domestic conditions with their husbands and, given the religious preferences of most white workers, were most men never home on a Sunday? Press reports gave ample coverage to Lloyd’s views on degeneration, seeking his opinion on women and children working in the cane fields. The Brisbane Courier’s special correspondent noted that “no one after conversing with the doctor, could fail to be seized with

7 All quotations from Lloyd, "The Medical Point of View," 7.
8 David M. Pomfret, ”'Beyond Risk of Contagion’: Childhood, Hill Stations, and the Planning of British and French Colonial Cities,” in Imperial Contagions: Medicine, Hygiene, and Cultures of Planning in Asia, ed. Robert Peckham and David M. Pomfret (Hong Kong: Hong Kong University Press, 2013), 81.
9 Mrs T.D. Chataway, "White Women in the Tropics," Cairns Morning Post, 13 August 1908. Chataway was the wife of T.D. Chataway, a Tory senator and chairman of the committee that produced the Mackay pamphlet.
the danger to the community of long persistence in such work”.

The federal member for Hindmarsh in Adelaide, James Hutchison of the United Labor Party, was less convinced. A fervent supporter of white Australia, the Scot had seen no evidence during his trip of any of the degeneration that Lloyd described and he did not find that the popular opinion of residents sided with Lloyd. If anything, he considered Lloyd’s description of the domestic milieu as evidence that “there is room for great improvement in the conditions surrounding the sugar industry, and that were this effected there would be little to fear from a health point of view”. Although Lloyd’s pessimism was dismissed by political supporters of White Australia, he had broadened the discussion on the sugar bonus to include consideration not just of male workers but of their wives and children, raising questions about whether there was a place for them in the tropics at all and, in the process, highlighting the difficulty of maintaining traditional ideals of white domesticity.

The pamphlet’s emphasis on the role of the physical environment in inducing racial degeneration was also challenged seven months later by the then Chief Health Officer of Tasmania, Dr. J.S.C. Elkington, in a lecture given to the Royal Society of Tasmania in Hobart. For Elkington, who had recently returned from a stint at the Imperial Plague Research Laboratory in Bombay, disease was the main cause of tropical ill-health, not climate. Elkington viewed the general negativity towards tropical climates as an historical problem stemming from travellers’ tales before the advent of tropical hygiene and a “deep-rooted prejudice against hot climates which is ancestrally implanted in Northern European peoples”. In his lecture, Elkington’s first move was to challenge the ‘tropicality’ (David Arnold’s term) of northern Australia, the imagined otherness to white Australians of the


region’s climate, industry and lifestyle.15 “To residents in the southern States”, he commented, “who have not visited these portions of their country which lie to the north of Rockhampton and west of longitude 145, the term ‘tropical Australia’ is apt to convey a mental picture of sundry sugar plantations and banana patches sweltering in the blazing sun”.16 The tropics, however, were not just for growing bananas and sugar but had the potential for a far wider range of primary industries, including mining, hydro-electric power generation and pastoral farming. Elkington reminded his Tasmanian audience of the geographical extent of Australia’s tropical territory, its varied topography and the many climates it encompassed. Tropical Australia was then thought to be either sweltering or arid, but Elkington showed it could actually be cool and breezy. In particular, he drew attention to the presence of elevated tablelands that offered “as ’bracing’ an atmosphere as can be found anywhere in the world”.17 With the help of some topographic surveys, Elkington was carving out ‘thermal enclaves’, pockets of thermally favourable territory. In other words, the tropics might naturally be more temperate than his audience had believed.

Having normalised the tropics, Elkington’s second move was to poke holes in Lloyd’s and others’ arguments that the physical environment itself caused degeneration. He highlighted Lloyd’s evidence that sanitation had greatly improved health in Mackay. He also made Lloyd appear out of touch with historic developments in tropical hygiene, citing findings from the Indian Sanitary Commission of 1863. These showed that preventable diseases and “removable conditions and habits”, not climate, were the cause of the deaths of European soldiers. In addition, Elkington pointed out that “Mackay and eastern coastal Queensland in general form, however, but a comparatively small proportion of tropical Australia, and cannot be regarded as a true index of general climatic conditions”.18 Where Lloyd had sought to extrapolate his experience of Mackay as relevant to all white settlers in the tropics, Elkington provincialised both the doctor’s understanding and the town’s climate.

16 Elkington, "Tropical Australia,” 3.
17 Elkington, "Tropical Australia,” 3.
18 Elkington, "Tropical Australia,” 4.
Elkington attempted to make climate less controversial, not by dismissing the symptoms that Lloyd and others had observed but by diminishing the role of climate and the thermal environment as causal factors. High temperature and humidity were still seen to cause discomfort, but it was largely a question of teaching people how to live and ‘unlearning’ the habits and customs of temperate lands. In addition, Elkington cited evidence from experiments by W.F. Tyler in Shanghai to show that the experience of heat was a subjective sensation. “Similar weather conditions”, he summarised, “may produce very different effects upon different individuals at the same time, and also upon the same individual at different times”.

Thermal sensation was now a subjective, not objective, response to climate.

Racial anxiety was replacing climatic anxiety, and Elkington saw tropical Australia as “a prize for the fittest”. “Successful colonisation” for Elkington involved “a considerable white population, working and thriving in tropical Australia, under an enlightened and progressive administration”. (Elkington himself became Queensland’s Commissioner for Public Health in 1910). Tropical Australia was “no place for weaklings and degenerates” and, he cautioned, the area was “a perpetual temptation to other races and peoples more appreciative of its varied endowments”. His image of an “enlightened administration” harnessed agricultural, veterinary and medical knowledge to “exclude, check and suppress all forms of preventable disease”. Elkington freely acknowledged this was already happening in the American occupation of Manila but he wished to go further and ensure that housing, diet, clothing and schooling would all be adjusted for tropical conditions. In short, Elkington sought to inculcate a new common sense and was proposing that political problems had medical solutions. With such “reasonable precautions” and the pull of industry, Elkington saw no reason why the population of tropical Australia “should not be a white one”.

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19 Elkington, “Tropical Australia,” 5.
Defining Thermal Limits

Although medical supporters of white settlement such as Elkington believed that disease and ignorance were the main impediments to colonisation, concerns about climate did not completely subside. Strangely, it was field research in England, not in more equatorial latitudes, that revised the view that the tropical environment was a safe place to work. As Australians found frost in the Atherton Tablelands, J.S.C. Haldane (1860-1938—a lecturer in physiology at Oxford) sweltered in the depths of a Cornish mine. Although best known today for introducing canaries into coalmines, Haldane’s thermal experiments on himself and his colleagues were among the first attempts to establish a reliable heat index. Haldane sought to determine “the limits within which men can exist normally, and to work, when the air temperature is abnormally high”. For Haldane, this was not just relevant to those working in the tropics. High temperatures were now the norm in many industrial workplaces in Britain, such as steamer engine rooms, pottery ovens, cotton mills and mines. Even the English outdoors in warm summer weather was thought to be a potential health risk. Tropical anxiety was reconstituted in Britain by way of the factory floor.

Up to the turn of the century, there had been little study of the internal temperature of healthy people. The ‘deep’ temperature could be recorded by taking the mouth, rectal or urine temperature. However, probing the body raised questions not only of truth but also of propriety. Haldane’s Oxford colleagues Marcus Seymour Pembrey (1868-1934) and B.A. Nicol investigated the body’s thermoregulatory system at the turn of the century. “For


obvious reasons of convenience and delicacy”, Pembrey and Nicol noted, “most
determinations of the temperature of man have been made in the mouth or the closed
axilla”. Pembrey and Nicol noticed that mouth temperatures were often lower than the
internal temperature due to the action of other physiological processes such as sweating, skin
radiation and cooling of the nasal passage. Rectal and urine temperatures were therefore
considered more reliable than the mouth as indicators of the body’s ‘deep’ temperature.
Pembrey’s and Nicol’s detailed study of variations in their own rectal and urine temperatures
gave an average maximum temperature of 99.4°F (37.45°C). Haldane later teamed up with
Pembrey in a more extensive study that examined the internal body temperature of 83
soldiers. “In 19 cases”, Haldane observed, “the temperature was 100°F (37.8°C) or more, the
maximum (two cases) being 100.8 [sic](38.2°C)”. This, along with his own experience in
the mines and laboratories, prompted Haldane to recommend a higher acceptable limit than
that given by Pembrey and Nicol. Accordingly, the urine temperature of two samples from
soldiers “wearing light, khaki uniforms” and who “had done no muscular work, and were in
good condition” helped set an upper limit of “normal rectal temperature” of 101°F (38.3°C)
for Haldane’s classic investigations of high temperature in 1905.

Haldane was curious about the effects of high temperature and humidity, but was
surprised that no study had been done to find where the physiological limit might lie. He had
established the need for his study after being called to investigate anaemia and phthisis
(tuberculosis) among miners in Levant Mine in Cornwall. The mine was poorly ventilated,
the air saturated and hot with dry-bulb temperatures as high as 102.5 °F (39.2 °C). Haldane,
wearing only a light cotton shirt, descended into the mine and “felt no inconvenience apart
from the excessive sweating”33. However his colleague, ‘J.S.M.’, dressed in an overcoat and
flannel shirt, became short of breath and requested frequent stops. Their comparative mouth
temperatures further convinced him that clothing was influencing his colleague’s

29 Pembrey and Nicol, "Observations upon the Deep and Surface Temperature,” 386.
30 Pembrey and Nicol, "Observations upon the Deep and Surface Temperature,” 392.
31 Haldane, "The Influence of High Temperatures. No.1,” 496.
32 Haldane, "The Influence of High Temperatures. No.1,” 496.
33 Haldane, "The Influence of High Temperatures. No.1,” 498.
physiological response. As for the workers, they seemed used to the conditions and in good health. Their health and acclimatisation did not help their productivity, however, as they seemed unable “to do more than a limited amount of work”.\textsuperscript{34} As ever, physiological research was justified in terms of its industrial potential.

The search for a safe, threshold temperature took place in both the laboratory and in the field. Haldane sought to observe any changes of body temperature as “the physiological disturbances were chiefly due to rise in body temperature”.\textsuperscript{35} A “warm incubating room” at the Lister Institute, London, and another at the Physiology Laboratory, Oxford, allowed Haldane and two assistants, Dr. Arthur E. Boycott and a young C.G. Douglas, to subject their own bodies to varying extremes of temperature and humidity in a controlled environment. Dolcoath Mine in Cornwall gave permission for Haldane to “ascertain the effects of motionless saturated air at different temperatures without work or a minimum of clothing”.\textsuperscript{36} Further studies at a Turkish bath in Oxford offered higher temperatures than those produced in the laboratory or mine, but contained only the moisture of the outside air, meaning that unlike the mine, the air was never saturated.

The descriptions by Haldane indicate how far they went to try to ensure that all temperature readings were commensurable. The thermometers used were “carefully compared pairs” which had been “compared with standard instruments verified at Kew and Charlottenburg”.\textsuperscript{37} The readings could be trusted. Before undertaking the study, however, Haldane needed to determine what a ‘normal’ body temperature was. He largely relied on a series of studies undertaken by Pembrey and colleagues (including himself) who had recently established that there were significant variations in the range and level of what they termed the ‘deep’ or ‘internal’ temperature of the body.

It is no surprise that Haldane used himself and two other physiologists as test subjects. Though they measured the mouth temperatures of miners and even took urine samples from

\textsuperscript{34} Haldane, ”The Influence of High Temperatures. No.1,” 498.

\textsuperscript{35} Haldane, ”The Influence of High Temperatures. No.1,” 495.

\textsuperscript{36} Haldane, ”The Influence of High Temperatures. No.1,” 499.

\textsuperscript{37} Haldane, ”The Influence of High Temperatures. No.1,” 495.
soldiers, all data on rectal temperatures in both Pembrey’s and Nicol’s study and Haldane’s experiments came from the physiologists themselves. Using thermometers in a high temperature environment carried its own risks. “In many experiments the thermometers had to be kept in continuously except when being read. In very hot air this precaution was necessary, as the thermometers could not have been read and would have very quickly burst if exposed to the heat outside”.38 It must have been quite a sight for workers to see Oxford dons taking rectal measurements in the middle of a mine shaft, but their results helped establish the wet-bulb temperature as an ideal heat index.39

Initial experiments in the torrid atmosphere of Dolcoath mine showed that it was impossible to maintain a normal body temperature. The wet-bulb temperature read 89°F (31.5°C) but Haldane found that, even after 2¼ hours and despite feeling alright with only a “slight throbbing”, the subject’s body temperature was still rising.40 Experiments at the Lister Institute, involving Haldane and Boycott, examined the effects of varying combinations of wet-bulb and dry-bulb temperatures. The wet-bulb temperature accounted for the combined effect of the air temperature and humidity, while the dry-bulb temperature recorded only the air temperature. By evaporating water in the room, the humidity could be raised without affecting the air temperature. They recorded their rectal, mouth and pulse temperatures, typically every 20 minutes. They noted any changes in physical sensation, such as when they were “sweating profusely”, or any feelings of discomfort, nausea, headaches or tiredness. The experiments normally ended when one of the subjects reached a rectal temperature of 101°F (38.3°C), the maximum limit of ‘normal’ body temperature. In some cases, monitoring continued after they had left the chamber.

Controlling humidity and air temperature levels in 1905 required certain improvisations. The incubating room at the Lister Institute was warmed by hot-water pipes, while the humidity was increased “by boiling a kettle in the room, and by leading steam in through a pipe”.41 The subjects found that the set-up was not ideal, as the air was cooler.

38 Haldane, ”The Influence of High Temperatures. No.1,” 497.
39 Lee, ”Seventy-five Years of Searching for a Heat Index ,” 331.
40 Haldane, ”The Influence of High Temperatures. No.1,” 501.
41 Haldane, ”The Influence of High Temperatures. No.1,” 501.
around the ground; Haldane noted that “at the knee-level the temperature by both wet and dry bulb was about 10°F lower”. He modified the set-up by erecting a platform and introducing steam at a lower level.  

In contrast, the physiology laboratory at Oxford was heated “by keeping gas burning in it continuously, with the windows and door shut”, with evaporating water *in situ* raising humidity levels. Researchers struggled, however, to produce high temperatures, as Haldane’s student Harvey Sutton indicated a few years later. “The room was heated by open gas flames”, Sutton observed in a footnote, “but ventilation from chinks, etc., was so free and the resulting loss of heat from the room itself so great that a sufficiently high temperature (33° C. wet bulb) could only be obtained on the hottest days in summer (20° C. or over)”. Researchers could still not fully isolate themselves from the outdoors in their Oxford laboratory.

Over the course of the study, Haldane found that subjects, if stripped to the waist, at rest and in still air, “showed no abnormal increase” in their body temperature until the wet-bulb temperature exceeded 88°F (31°C). In still conditions at this temperature, Haldane and Boycott frequently described feeling comfortable, “all right”, or having “no discomfort” despite profuse sweating or a slight throbbing. “If, however, the wet-bulb temperature exceeded this temperature by even 1 degree, a very marked rise in [rectal] temperature occurred”. Haldane identified an increased pulse rate, throbbing of the head, breathlessness, exhaustion and discomfort as the main symptoms that went with rising body temperature. Although higher dry-bulb temperatures did not seem to matter, moving air could raise that limit.

Haldane and Boycott also wished to simulate physical work and used a small step-ladder as a proxy for moderate physical exercise. “Muscular work” in still air could also greatly decrease the maximum permissible wet-bulb temperature. The results produced by walking up and down a step-ladder four times per minute inside a gas-heated chamber

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43 Harvey Sutton, "The influence of high temperatures on the human body with regard to heat stroke," *The Journal of Pathology and Bacteriology* 13, no. 1 (1909), 63.


suggested to Haldane that, beyond 78°F (25.5°C), “continuous hard work becomes impracticable”. 46 Haldane claimed to be comfortable despite sweating profusely, even at wet-bulb temperatures of 89°F. However he expressed concern that his body temperature was continually rising at this temperature. He warned that “beyond about 88°F, or 31°C, it becomes impracticable for ordinary persons even to stay for long periods in such air, although practice may increase to some extent the limit which can be tolerated”.47 He repeated these assertions when called to give evidence before the Parliamentary Committee on Humidity and Ventilation in Cotton and Weaving Sheds, graphing the various experiments (fig 2.1) to show that in still saturated air, when stripped to the waist and at rest, the wet-bulb rather than the dry-bulb temperature affected the body’s internal temperature when the wet-bulb exceeded 88.5 degrees Fahrenheit. 48 Haldane’s experiments had revealed the body’s thermal limit and validated the wet-bulb thermometer as the preferred instrument for measuring thermal sensation.


Limiting temperatures, according to Douglas Harry Kedgwin (DHK) Lee, who we will return to in Chapter 4, may be a threshold, precautionary or a comfort boundary.\(^{49}\) A threshold limit assumes that bodily harm will occur once that threshold is passed. A precautionary limit, on the other hand, assumes that the temperature may be surpassed, provided certain precautions are taken. Finally, a comfortable temperature is one about which people are likely to express satisfaction or unlikely to offer a complaint. Haldane’s recommendations of 88°F and 78°F as limiting temperatures were precautionary limits. As the temperature passed these limits, increasing precautions had to be taken. Beyond 78°F, “continuous hard work” had to cease.

\(^{49}\) Lee, "Seventy-five Years of Searching for a Heat Index ,” 352-53.
while beyond 88°F wet-bulb temperature acclimatisation, ventilation or a time limit for exposure was necessary.

His 26 experiments on himself and two colleagues, he concluded, were significant. “The bearing of these experiments on the question as to the rise in temperature allowable on economic or humanitarian grounds in places where persons have to work continuously will be sufficiently evident”.50 Physiologists around the world took note and the paper temporarily suggested that the wet-bulb temperature could be a reliable heat index. It allowed for “instrumental simulation”, where the wet-bulb thermometer could simulate the human body’s reaction to its thermal environment in a “quantitatively comparable” manner to that of a real body.51 Thermometers could take the place of people, or at least people in humid environments, either underground or enclosed as in a laboratory or a Turkish bath.

Spatialising Heat Indices

Haldane’s work was a source of inspiration for the University of Melbourne’s Professor of Physiology, William Osborne, who promoted developments in physiology through his articles and editorials in the Argus and Age newspapers. Osborne was particularly interested in how sweating worked to maintain the body’s thermal equilibrium and sought to raise public awareness about the dangers of working in environments with high wet-bulb temperatures. In an article on “Heat and Health” published at the height of summer in 1909, Osborne laid out the body’s principal mechanisms for maintaining uniform temperature. 52 He informed his readers of the problems of relying on the dry-bulb temperature as a guide to overheating, and how the wet-bulb temperature was a better solution. Some subtle changes occurred in Osborne’s popular translation of Haldane’s work. To Osborne, “the animal body resembles a wet-bulb thermometer in this, that its surface is moist.” Animals were simulations of the truth of instruments, not the other way around. In addition, Haldane’s

50 Haldane, "The Influence of High Temperatures. No.1,” 513.
51 Lee, "Seventy-five Years of Searching for a Heat Index,” 332.
precautionary limit of 88 degrees was now a threshold limit, with mortal consequences if surpassed:

Should the wet-bulb read 88 deg. Fahr. then, as Dr. Haldane has shown, the body, even though it remain as completely at rest as possible, will, by virtue of the chemical processes which of necessity go on within the living tissues and which generate heat, rise in temperature until death occurs.\(^53\)

Osborne’s article not only informed and cautioned the public, but also solicited money. He sought to undertake laboratory study on “the effect on the human body of the climatic conditions that prevail in our state both winter and summer”. With a cash-strapped university and private donations hard to come by, Osborne had to look elsewhere. The Royal Society of England stepped in to fund equipment but, he noted, “for the maintenance of the investigation another sum will be required, and, it is hoped that this amount may be obtained without an appeal being made outside our frontiers”.\(^54\) Osborne described the significance of Haldane’s findings for many Australian workplaces and identified the practices that would require either reform or thermal monitoring on hot, humid days. Work would be arranged on physiological lines. Yet this was all a preamble to Osborne’s final paragraph on the dearth of funds for local research. For Australian physiology to be locally relevant, it needed local funding.

Osborne’s University of Melbourne colleague, Sir James Barrett, agreed. Rather than lobby his readers he used the press to solicit government funds. In September 1910, he penned an article in the *Argus*, pleading with the government to appoint a scientific commission to research the safety of settling tropical Australia.\(^55\) A previous attempt in 1908 had fallen on deaf ears, being interpreted by politicians, according to Barrett, as “an attack on the White Australia policy”. Barrett maintained that compiling information to enable white settlement was of great necessity, particularly due to the threat of developing empires. In a similar vein, a year later, he concluded that “no people can permanently hold a country which

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\(^53\) Osborne, "Heat and Health,” 6.

\(^54\) Osborne, "Heat and Health,” 6.

is thought to be valuable without either developing it themselves or permitting someone else to do so.” 56 It was a case of use it or lose it.

A central tenet of Barrett’s proposal was the need for a compilation of wet-bulb isotherms for all of Australia. Reminding his readers of Osborne’s article on Haldane, Barrett proposed mapping annual, seasonal and daily wet-bulb isotherms to find out which parts of the continent were suitable for white colonisation. “It will be possible,” Barrett imagined, “to give directions to the pioneers and to indicate to them the times of the day and other conditions in which their work is most likely to be effective. It will be found that certain regions usually regarded as very hot are not really exhausting, and that others with much lower shade temperatures will require careful attention”. 57 In Osborne’s and Barrett’s hands the wet-bulb thermometer became a tool for workplace management and ‘scientific’ settlement. Wet-bulb temperatures were no longer just an indicator of atmospheric humidity but, now spatialised, were a thermal frontier; isotherms could form settlement boundaries.

Osborne’s and Barrett’s advocacy of the use of wet-bulb temperature as a threshold limit to settlement captured the attention of the Scottish geographer and geologist, John Walter (J.W.) Gregory. A former Professor of Geography at the University of Melbourne (1900-1904), Gregory presented the case for “The Geographical Factors that Control the Development of Australia” to an audience at the Royal Geographical Society in London on February 7, 1910. Although Gregory paid attention to the continent’s physical geography, human population and economic resources, he devoted half of his speech to “the problem of tropical colonisation” and the consequent development of Queensland and North Australia. Unlike James Barrett, he did not agree that the Commonwealth of Australia was obliged to use all of its land to claim sovereignty over it, as he did not consider that this applied to “the empty spaces of Brazil, of Northern Canada, of German South-West Africa, or of Asia”. 58 To Gregory, it was a false argument, useful only for European empires to divide up Africa. 59


was similarly sceptical of most of the physiological arguments raised against permanent white settlement of the tropics, quoting Osborne’s dismissal of “the futility of some of the traditional assertions on the subject”.60 Nor was Gregory swayed by any medical claims of racial exceptionalism. Believing that technology neutralised any ‘natural’ advantage, he found no evidence from any “expert physiologists” that there were any climatic factors that made the tropics healthier for coloured over white people. “A black man would unquestionably have a great advantage in the tropics over a white man if they both worked naked; but clothing of suitable materials, opaque to the actinic rays, provides adequate protection”.61 The only physiological factor that Gregory believed required careful scrutiny was “the combined effect of heat and moisture”.62 He subscribed to the findings of the research by Haldane, Cadman and Osborne that “life itself may be threatened at wet-bulb temperatures of 85° to 88°”.63 He even quoted at length some of Osborne’s preliminary information on wet-bulb measurements around Australia, a number of which were in the danger zone. Yet, for all his interest in Osborne’s research, Gregory did not believe it would determine the success or failure of tropical settlement. “The high wet-bulb temperature”, he concluded, “may be non-effective, as it would be as fatal to the blacks as to the whites”.64 In Gregory’s lecture, racial equality became an argument for greater rather than lesser commitment to colonisation.

Despite Gregory’s arguments in London, Barrett and Osborne managed to convince the Commonwealth’s chief meteorologist, H.A. Hunt, to provide reports of wet-bulb temperatures from around Australia. Monthly weather reports, starting in 1910, listed daily wet-bulb temperatures for the metropolitan weather stations at 9am and 3pm and average monthly 9am wet-bulb temperatures for smaller stations around the country. The first drawings of wet-bulb isotherms came out in the Commonwealth Bureau of Meteorology’s monthly weather report’s annual summary for 1910 and were “compiled from 9 a.m.

observations only”.65 They were later republished in large format in 1913 (fig. 2.2).

“Measured by the wet bulbs”, Hunt wrote, “the hottest part of Australia appears to be the strip of coast on the north-western aspect running from Cossack to Port Darwin, with a mean wet bulb temperature of 80 degrees, and the coldest region the south-eastern corner of the Continent and Tasmania, where the mean temperature of evaporation is from 45 to 50 degrees”. 66 Barrett and Osborne interpreted the graphs with satisfaction: “The wet-bulb temperature, even in summer, only rises above 80 degrees Fahrenheit in a very limited area, the worst portion of the continent being in the north-west near Broome”.67 Further, if railways connected the Territory to “the healthy New England country of New South Wales”, Barrett believed sick residents would have access to milder climes. Given these developments, Barrett believed future settlement was likely to be a success.

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Figure 2.2. Charts Showing the Mean Monthly Wet Bulb Isotherms for the Year 1910. Source: H.A. Hunt (map), “Charts Showing the Mean Monthly Wet Bulb Isotherms for the Year 1910, compiled from 9 a.m. observations only,” Commonwealth Bureau of Meteorology, 1913.

To Barrett, Osborne and Hunt, the wet-bulb isotherms demonstrated the general suitability of tropical Australia for outdoor work, but required considerable adaptation of housing standards. Echoing Dr. Lloyd in 1905, Barrett claimed that, although men seemed able to work outdoors in the tropics without hindrance, women confined to the home looked weak. “It is a familiar experience in the centre of Queensland”, he wrote in a 1912 opinion piece for the London Morning Post, “where the heat is supposed to be intense, that the men who work out-of-doors are strong and robust. The women, living mostly in unsuitable houses really modelled on British lines, suffer from anaemia and neurasthenia, although the wet-bulb
temperature in Central Queensland is not very high” 68 While Lloyd had questioned whether the tropics were suitable for any settler without financial means, Barrett now considered the north of Australia, in such conditions, suitable for men only.

Yet Barrett was optimistic that women’s difficulties could be solved through ‘scientific adaptation’ and the control of tropical disease. Yet, like the sugar producers in 1905, Barrett still questioned the economic feasibility of the enterprise. The problem was that white labour cost too much to compete with tropical industry elsewhere. “Tropical agriculture in general is hopeless”, he lamented, “if the product must be sold in the markets of the world. When rubber is produced by tapping coolies, at 10d. a day, in Malaysia, what hope is there in Australia of growing rubber with the aid of men who require 12s. or 15s. a day?” 69 Only pastoral industries seemed initially feasible, with some hope that the growth of railways would allow for larger populations and, with them, some unspecified new industries. Unlike Elkington, Barrett was more guarded about the economic potential of northern Australia and advocated a slow and systematic process of settlement. “When the temperate parts of the continent are full”, he reflected in 1918, “the flood will gradually extend into the tropics. Of immigration, as elsewhere, it may be truly said there should be neither haste nor pause”. 70

Hidden behind Hunt’s isotherms were some specific assumptions. Weather data became climate records within the space of a year, as attested by the annual weather report for 1910. Even though Brisbane’s monthly weather report showed two days in January where the average 3pm wet-bulb temperature was over eighty degrees Fahrenheit, neither Hunt, Osborne nor Barrett commented on this. Hunt’s colleague, Thomas Griffith Taylor, noted in 1916 how many of the Queensland stations were only in operation for a few years, but argued that future maps would “differ only in detail from the present set, and such difference can

69 Barrett, The Twin Ideals, 304.
have no effect on the broad climatological problems”.

Nor did they seem perturbed by the fact that the map of isotherms came from the mean monthly temperature, which smoothed out any variations across the month. This also was a 9am reading, which was unlikely to give the highest reading of the day. In contrast, the statistics on air temperature continued to show the mean maximum temperature for the month as well as the absolute maximum temperature. Haldane’s measurements were not based on a statistical response but on individual cases, with a critical environmental temperature based on the experience of four or five physiologists in mines, laboratories and Turkish baths in England.

In England itself, the discussion centred on regulating when and for how long people could work in hot and humid artificial environments. In Australia, the debate was more about where people could work. When Haldane and Boycott were called to give evidence before the Parliamentary Committee on Ventilation and Humidity in Cotton and Weaving Sheds in 1909, they all recommended that at no time should the wet-bulb temperature exceed 75 degrees Fahrenheit (28.9°C) and expressed a preference for 70 degrees Fahrenheit (21.1°C) as a safe working limit. This was despite the concerns expressed by others on the committee that lower wet-bulb temperatures might artificially be obtained on warm summer days. Yet when Haldane’s research was translated and spatialised into a tactic for racial settlement, its Australian promoters did not seem concerned to find any data for the times of day or dates on which the temperature exceeded their preferred threshold or precautionary temperature. Rather, the information was used to back their pre-existing and highly general argument that the tropics were, tout court, likely to be safe for settlement.

Environmental Determinism

At the turn of the 20th century, the young discipline of geography was struggling to gain an academic foothold and be taken seriously. It was, according to one of Oxford’s early


72 It is true, however, that a number of experiments since 1905, by Cadman, Sutton and Osborne, independently verified Haldane’s claims.
students, J.F. Unstead, a “thing of shreds and patches with very little educational value”. 73 A.J. Herbertson, the director of the Oxford School of Geography, was looking to find a more systematic approach to the development of a logical system of land classification. Defining geography as “the science of distributions”, he argued that geography ought to be about “the study of phenomena from the point of view of their distribution on the surface of the Earth, in natural groups, and not as isolated phenomena”. 74 His concept of “natural regions” was his major contribution to the nascent field, which he refined until his death from overwork in 1915. 75 Herbertson’s system divided the world into zones with similar climate, topographical configuration and vegetation patterns. It was an attempt to move away from using political divisions as the boundary for geographic study and, when first presented in 1904, it was regarded as “literally epoch-making”. 76

Though Herbertson’s concept of natural regions masked the political divisions of the world, it clearly linked the physical environment with a region’s agricultural potential and political history. In his textbook Senior Geography, first published in 1907, Herbertson struggled to subsume the political beneath the natural environment. His introduction made much of the desire to get away from ageography of political divisions, but this was not followed through in the book’s structure. While a whole chapter introduced the comparative potential of natural regions, the subsections of the book used chapter headings that jumped between political and ‘natural’ divisions. Some chapters concerned the geography of a country or empire, while others were about one of Herbertson’s natural regions, such as the Turan type. Yet within each chapter, the links between the physical and agricultural environment were continuously reinforced. Each chapter began by describing the physiography and climate of the region and then listed the fruit, crops and types of animals produced. The instrumental valued of this method was clarified when Herbertson explicitly linked the potential of studying natural regions to the project of tropical colonisation by

73 J.F. Unstead, "A.J. Herbertson and his Work,” Geography 50, no. 4 (1965), 343.


75 Unstead, "A.J. Herbertson and his Work,” 344.

76 Unstead, "A.J. Herbertson and his Work,” 344.
Europeans and the ‘development’ of tropical resources. “A scientific study of the natural regions of the world”, he argued in 1911, “would simplify their [Europeans’] task, and would save failures, by showing where experience gained in one part of the world can be applied in another”. With Herbertson’s system it did not matter who controlled the land, as political divisions no longer counted, but it did matter what the European experience of that land was.

While A.J. Herbertson was working in England, mapping the world’s natural regions, the American geographer and fellow environmental determinist, Ellsworth Huntington (1876-1947), was developing his theory that the settlement patterns, habits and character of a people were moulded by both the physiographic environment and climate change—In short, that civilisation was determined by climate. While a student at Harvard, Huntington came under the influence of William Morris Davis, who pioneered the study of physical geography and was a close friend of Herbertson. Yet like many of Davis’s students, such as Isaiah Bowman and Mark Jefferson, Huntington reacted against Davis’’s obsessive study of landform and sought to answer questions about how changes to the physical world influenced human societies.  

Huntington undertook field work between 1904 and 1909 to investigate the historic desiccation of lakes and streams in Central Asia and the Middle East. In many cases, older ruins were found where lakes and rivers had dried first. He was convinced by these studies that civilisations had risen and fallen according to sudden climatic changes or, as he termed them, “climatic pulsations”. His geographic theory of history extended into the present via his study of the effect of climate on workplace productivity. He had been inspired, he claimed, by a manuscript sent to him by Charles J. Kullmer, Professor of German at Syracuse University, who had noted what appeared to be a “remarkable similarity between the distribution of cyclonic storms and of civilization”. Although Huntington acknowledged


that others had already looked at the effect of climate on people’s behaviour,\(^{81}\) he did not believe that such studies were based on a large enough sample in a wide range of climates.\(^{82}\)

Huntington admitted that the ideal way to test his hypothesis would be to take a large group of people and examine their daily activity first in one climate and then in another. However he doubted the practicality of such a program on account of its expense and suggested that “results would be open to question”.\(^{83}\) Instead, he sought evidence from people’s activity levels in locations having “a variable climate”. “The best test”, Huntington claimed, “is a man’s daily work, the thing he devotes most of his time and energy”.\(^{84}\) He refined his thesis of the relative effect of the climatic elements on individual productivity by gathering data on the daily exam scores of naval recruits in Annapolis and West Point academies and the piecework outputs of factory operatives in New Britain and Bridgeport (Connecticut), Pittsburgh (Pennsylvania) and Jacksonville and Tampa (Florida). By graphing outputs against outdoor temperature, he found that the highest test scores correlated with an average outdoor temperature of 38 °F and that the maximum physical outputs of workers occurred when the outdoor temperature was 68°F. However, Huntington did not particularly question his own methodology. It did not matter that students were in recess during the hottest months of the year, or that factory and exam work was taking place indoors.

Huntington realised that the climate people thought of as ideal really depended on what they wished to do:

For rest and recreation a warm, equable climate is doubtless most delightful; for a fishing or climbing trip something quite different is desirable. For most people the really essential thing in life is the ordinary work of every day. Hence, the climate which is best for work may in the long run claim to be the most nearly ideal.\(^{85}\)


\(^{82}\) Huntington, *Civilization & Climate*, 7.

\(^{83}\) Huntington, *Civilization & Climate*, 7.

\(^{84}\) Huntington, *Civilization & Climate*, 8.

\(^{85}\) Huntington, *Civilization & Climate*, 129.
Huntington used his findings on the ideal climate for productive work to produce a map showing “The Distribution of Human Energy on the Basis of Climate”. To Huntington, this spatialisation of human energy had great industrial value:

For instance, we shall be able to determine in what parts of our country or of the world the greatest amount of either mental or physical work can be accomplished. We shall be able to measure the differences in the efficiency of labourers and other workers of various races, and shall use these differences as the basis for determining where factories, schools, or other institutions can most profitably be located. We shall find that certain climatic conditions which seem pleasant are in reality debilitating. And, above all, we shall discover exactly what conditions are most harmful in such places as the tropics. With this knowledge we shall go to work, not to change the climate, but to supply some sort of stimulus or other corrective which shall overcome the effects of the specific meteorological conditions which are proving most harmful.86

Both Herbertson and Huntington sought to enable comparison between diverse regions of the world in order to understand the economic value that could be exploited from the land or the ‘natural energy’ of a people. In effect, they sought to naturalise particular systems of agriculture or office work and quantify the ‘natural’ economic potential of any location. As Richard Peet has noted, environmental determinism—the belief that society is determined by its physical environment—was geography’s contribution to Social Darwinism. It legitimated imperial conflict and conquest by downplaying its socio-economic dimensions and emphasising biological differences instead.87

The physiographer and former Antarctic explorer, Thomas Griffith Taylor (1880-1963), introduced the method of comparative climatology to Australia, inspired by the environmental determinism of Ellsworth Huntington and the regional geography of A.J. Herbertson. Educated in geology, engineering and palaeontology at the Universities of Sydney and Cambridge, Taylor worked in Melbourne under H.A. Hunt at the Commonwealth Bureau of Meteorology. Between 1915 and 1918 he produced a series of three bulletins for the Bureau of Meteorology and the Commonwealth Advisory Council of Science and Industry looking at the climatic control of settlement in Australia. His separate


Commonwealth publications examined where people could live and work in comfort, the regional distribution and rainfall cycles across the continent, and which parts of the continent were climatically suitable for cattle, sheep and wheat production. These publications adapted Huntington’s ideas on human energy and Herbertson’s system of regional classification to a live project—the mass settlement of the Northern Territory and Queensland. His publications brought his research and graphical techniques to the attention of an international audience, to the extent that by the early 1920s international scholars considered him one of the leading experts on theories of race, climate and settlement.

Whereas Herbertson largely confined the scope of his investigation to understanding the industrial potential of similar ‘natural regions’, Taylor expanded the scope of the investigation to consider the habitability of a place. Although Taylor believed Herbertson had come up with the classification system that “best satisfies (among the many suggested) the needs of the geographer”, he devised two new graphic techniques to represent the agricultural potential and thermal comfort of a location’s climate, which he termed the ‘hythergraph’ (fig. 2.3), respectively. His Bulletin No. 14 on “The Control of Settlement by Humidity and Temperature (with Special Reference to Australia and the Empire): An Introduction to Comparative Climatology” presented climographs of 14 ‘natural regions’ that largely followed Herbertson’s naming system. On a single page, places with distinctive social and cultural traditions due to their supposedly similar natural environment and

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agricultural potential were all presented together. In that sense, ‘Tokio’ [sic], New York and Toronto were all commensurable and comparable, as representative cities of Herbertson’s ‘Quebec type’. However, they were naturalised by their supposed climatic similarity and freed of any architectural or clothing traditions that mediated the environment in these locations.

Figure 2.3. Typical Hythergraphs for Tropical Australia. Source: Taylor, “The Settlement of Tropical Australia,” 102.

Physiologists such as Osborne were far more interested in atmospheric humidity than in rainfall, but predicting the coming of the rains had been one of the meteorologys *raisons d’être* since the almanacs of Greek and Roman farmers.⁹⁴ Rainfall, in Taylor’s view, was “the primary factor in Australian economics”, ⁹⁵ setting a climatic limit on agricultural

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productivity and, in Taylor’s mind, on the wealth and population density of a region. He developed the hythergraph (hyther was an amalgam of the Greek for water and heat) for agricultural production to show “where various crops are likely to grow most luxuriantly”. The hythergraph (fig 2.3) plotted along the ordinates average monthly rainfall and air temperature, which Taylor initially considered to be the main controlling factors that determined the regional suitability of plants. Primarily interested in tropical settlement, Taylor created a reference standard which he called the ‘tropical hythergraph’. It was a composite hythergraph whose boundary included most of the hythergraphs from representative towns located within the Australian tropics. Towns such as Darwin or Alice Springs were ‘typical localities’ in the tropics which, Taylor noted, had ‘opposite type’ hythergraphs—thin and horizontal in the case of Darwin, with its variable rainfall and near constant temperature; thin and near vertical in Alice Springs, with its low level of rainfall but variable annual temperature.

Whereas other weather reports might show drawings of isotherms across a geographical landmass or hatched areas of average rainfall levels, Taylor sought to introduce a novel method to “enable one to contrast the climates of any number of places at a glance”. The ‘climograph’ compared the suitability of a location’s climate for ‘comfortable’ settlement by Europeans. Each climograph (fig 2.4) plotted a location’s mean monthly wet-bulb temperature and relative humidity within a Cartesian grid, with percentages of relative humidity along the abscissae and wet-bulb temperatures along the ordinates. The graph was divided into four quadrants based on what Taylor considered to be the ‘four extremes’ of climate—muggy (hot and damp), scorching (hot and dry), raw (cold and damp) and keen (cold and dry). The climograph allowed different climates to be compared not only with each other but also against both a “tentative scale of discomfort” and an ideal “white race

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97 Taylor, "The Australian Environment," 30. Taylor dismissed soils as a control in the 1918 publication; while relevant, he claimed that the soil fertility was assured in the ‘huge tropical tract we are considering’ on account of the many undeveloped river flats. He later revised this assessment of soil fertility in more detailed regional studies of tropical Australia. See for example Taylor, T. Griffith. "The Settlement of Tropical Australia," 103-104

98 Taylor, The Control of Settlement, 8.
climograph based on twelve typical cities”. The links between climate and comfort were not only graded but also idealised and racialised.

Figure 2.4. Climograph Illustrating the Tentative Scale of Discomfort. Source, Taylor *The Control of Settlement*, 22.

The tentative scale of discomfort on the climograph reinforced the perception of England as the climatic home for the Anglo-Saxon ‘race’. Taylor was clear that the scale was tentative and based on his own experience of living and travelling in Britain and Australia. Thus his memory of London’s climate in April and October informed the choice of a wet-bulb temperature of 45-55 °F, which he took to be “an ideal climate for physical comfort”.99 His next grade, 55-60°F, which he claimed was “very rarely uncomfortable”, was based on the

summer average for London, the Melbourne winter and late spring and early autumn in Sydney, along with “a host of other flourishing white cities”. More severe levels followed, in steps of 5°F, based on summer months in Sydney and Brisbane; from this, Taylor explained the number of ‘muggy’ days to be expected at any particular level. The upper level of the scale of discomfort was still below Haldane’s mythical 78°F wet-bulb temperature, which had so preoccupied Barrett and Osborne. Indeed the definite limit of discomfort was set by Taylor as lying somewhere between 70-75°F. He based this upper limit on his own discussions with Osborne and on Mark R. Lamb’s “Curves of Comfort” (fig. 2.5). According to Taylor, Lamb had named 73°F as “the Rubicon” temperature. Taylor relied on his own thermal memories to decide on the comfort bands or, as he put it, “Australian and English experience”. This was in marked contrast to Haldane’s and Osborne’s earlier laboratory experiments, in which researchers freely recorded and described their own subjective experiences of the thermal environment during the experiment itself. Haldane and Osborne, however, were not interested in identifying the preferred standard of comfort, only in ensuring that workers could maintain their health.

100 Mark R. Lamb, "Curves of Comfort,” *Mining and Scientific Press* 101, no. 9 (1910).


Osborne’s continuing influence may be seen in Taylor’s use of the wet-bulb temperature. Taylor was explicit in his thanks to the professor, whom he acknowledged had reviewed the main part of his study on temperature and humidity. He was aware of the disdain many physiologists expressed towards using air temperature and relative humidity as heat indices, yet was cautious about introducing any new methods of measurement. New instruments, promoted by physiologists, would account not just for the air temperature or vapour pressure but also for the cooling power of the wind and radiant heat exchange. The British physiologist, Leonard Hill, was busily promoting his ‘katathermometer’, a modified hygrometer, and even Osborne had developed an ‘evaporimeter’ to simulate the heat lost

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through sweating. Taylor acknowledged these developments in his publication but remained sceptical of all of this innovation in instrumental simulation. The cash-strapped Bureau of Meteorology relied on a network of volunteer observers across the continent and was already struggling to receive consistent, reliable records on a daily basis.\footnote{The difficulty with relying on private observers was best illustrated by the failure of the first planned forecast of the Bureau for New Year’s Day 1908. No data arrived from either South Australia or the Northern Territory as, presumably, private festivities trumped public duty. H.A. Hunt, "Instructions to Country Observers,” ed. Commonwealth Meteorology (Sydney: William Applegate Gullick, Government Printers, 1907). A booklet containing instructions for Country Observers was issued in 1907 in an attempt to standardise terms, recordings and understanding of instrumentation. The system was not perfect as it relied not only on commensurable observations but also on access to the postal service to telegraph recordings back to the Federal Bureau each morning. Ideally, to form an accurate picture of the weather, all observations would be taken at the same time across the continent, which was set as 9 a.m. Standard Time in Melbourne. However “in Western Australia,” the Melbourne Argus noted, “for telegraphic reasons, the observations are not synchronous, but as made at 8 a.m. – one hour late, since 7 a.m. in Western Australia is 9 a.m. in Melbourne” H.A. Hunt, "Our Weather Bureau. Visit of the Meteorologist. A chat with Mr. Hunt,” Sydney Morning Herald, April 23, 1908. Hunt expressed a conservative ‘wait and see’ attitude to adopting new types of instruments. He noted, in 1908, the lack of consensus between many meteorologists in America and Europe on instrumentation. While he was quick to trial kites in Melbourne for taking high altitude readings, he recognised that the French system of using sound balloons might be more effective (Weather Prophecy: How it is done: Federal Bureau at Work,” Argus, January 18, 1908, 6.)} “It is impossible”, Taylor noted, “to expect that all the information desired by the physiologist shall be recorded at stations largely run by country farmers and postmasters”.\footnote{Taylor, The Control of Settlement, 9.} Taylor was reluctant to introduce any new variables to measure, arguing that wet-bulb temperature and relative humidity were similar to the factors measured by Hill, and he dismissed the perfectionism of physiologists who asked for records of wind velocities.

As well as graphically indicating the likely sensation of heat and degree of discomfort, Griffith Taylor sought to enable comparison between climatic variability and what he considered to be a racial ideal. He was inspired by Huntington’s map from the previous year\footnote{Huntington, Civilization & Climate, 142.} showing “the distribution of human energy on the basis of climate” and he
even went to the trouble of including a full page reproduction of the map. Taylor’s “white race climograph” was created by taking the average monthly wet-bulb temperature and humidity from 12 cities that Taylor considered were “typical of the regions where white energy is at its best”. He did not define exactly what he meant by either white or human energy, despite his references to Huntington’s work. It was left as a loose term, correlated to “work done in physical and mental fields” and a “region’s suitability for close white settlement”. All but one city (Berlin) was in the Anglo-sphere and although Taylor, like Huntington, favoured the English climate as an ideal, he weighted his choice of cities towards many in the warmer southern hemisphere dominions of South Africa and Australia. Taylor noted the “unavoidable error” of mixing his means. In most of his datasets, mean monthly relative humidity was derived from daily morning readings while mean monthly dry-bulb temperatures were based on the full 24 hour records. He claimed, however, to have tested a range of iterations and found that the shape of the climograph was maintained in all instances with only small changes of position. He noted with satisfaction how closely his white race climograph agreed with Huntington’s ideal of high human energy. Huntington himself returned the compliment when he favourably reviewed his method for an American audience. By different methods they had both arrived at the same result.

It seems strange that, as a self-professed ‘man of science’, Taylor was ready to overlook Huntington’s dubious methodology, which calculated human energy based on output curves without any ordinate dimensions (or conversion to foot pounds as Haldane had done). Huntington was notorious for fitting facts to his theories and, while the map’s scale was admittedly tentative, Taylor was still reproducing Huntington’s graph of “temperature

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107 Taylor, The Control of Settlement, 18-19.
108 Taylor, The Control of Settlement, 18.
109 Taylor, The Control of Settlement, 18.
110 Taylor, The Control of Settlement, 9.
control of mental and physical energy” even in 1961.\textsuperscript{112} By reproducing Huntington’s map so prominently in a government publication, Taylor gave official sanction to the American geographer’s often controversial ideas and drawings. It was a mutually beneficial relationship that developed into personal and intellectual camaraderie, with both enthusiastically promoting each other’s work, even where the rigour of the scholarship was found wanting.\textsuperscript{113}

The hythergraph and climograph were not the first attempts by Taylor to devise a graphic method that allowed for climatic comparison between locations. Three years earlier, with his colleagues Hunt and Quayle, he plotted monthly wet-bulb and dry-bulb isotherms for January and July 1910 on a map of Australia (fig. 2.6) while also indicating the areas that had high humidity, with percentages indicated for the major city.\textsuperscript{114} It was a clear development of Hunt’s wet-bulb isotherm map, which was rarely used by Taylor in subsequent years. The map provided no interpretive guidance other than the indication of areas having “high humidity”.\textsuperscript{115} A second lattice-grid image in the same publication, of a type Edward Tufte would now refer to as a “small multiple”,\textsuperscript{116} plotted the variation for six capital cities and three regional towns of average maximum and minimum temperature and relative humidity (ordinates) against time. The novelty of the method was suggested by the paragraph explaining how to interpret the graphs, in particular how to use the graph to obtain differences in the mean daily range for different points of the year. But that was it. Taylor’s climograph on the other hand introduced three different interpretive categories—thermal sensation, discomfort and energy.

\begin{quote}

113 Strange and Bashford, Griffith Taylor: Visionary Environmentalist Explorer, 98-100.


115 Nor did the text discuss the importance of understanding the wet-bulb temperature as a comfort index, as Taylor did in The Control of Settlement.

\end{quote}

Taylor’s publications used A.J. Herbertson’s 1905 system of regional classification to organise datasets into the “major natural regions”. His method could not be more different from that of Osborne and Barrett, who studied the suitability of tropical Australia for European settlement solely from the point of view of a single meteorological variable from
which to set a limit on where people could reside. Taylor was less optimistic than the Melbourne medical fraternity about the feasibility of settlement in tropical Australia. While Barrett claimed that only a small part of north-western Australia, centred around Broome, was unsuitable, Taylor blacklisted towns lying in what he termed the “Australian Monsoon Region” which had high wet-bulb temperatures and humidities in summer and dryer conditions in winter. Carnarvon, Nullagine, Daly Waters, Hall’s Creek and Wyndham in Western Australia; Darwin in the Northern Territory and Thursday Island and Townsville in Queensland were all found to be “unusually uncomfortable” during at least the summer months. “This is indeed not a very hopeful deduction as regards our north coast ports”, he lamented. “It is only necessary to compare them with the Indian climographs, when it will be seen that Darwin and Thursday Island in summer are very little better than Madras, while Wyndham and Daly Waters are not so favourable as Jhansi and Hyderabad respectively in central India”.  

Though he acknowledged that sea breezes might ease discomfort along the coast, he noted that it was still unclear what effect air velocity had on the wet-bulb temperature. Towns such as Darwin, Wyndham and Thursday Island, whose mean monthly wet-bulb temperature was over 75°F, were suitable for neither close nor continuous white settlement, in Taylor’s opinion. In future, Taylor admitted, a technical solution might be found. Osborne’s suggestion of adapting American domestic refrigeration techniques might “insure restful nights in our far north throughout the summer”.  

Yet he believed that only a select few would be provided with such measures and, thus, be able to live there.

Taylor’s pessimism also reflected the wider range of climatic variables for which he tried to account. Although he frequently treated climatic elements in isolation—as, for example, in his separate studies of rainfall or temperature and humidity as controlling factors on settlement—he later attempted to treat these elements holistically by assessing regions in terms of their habitability. Like Henderson, he still sought to synthesise multiple phenomena into a coherent whole. Using a weighting system, which gave points to a location’s thermal, rainfall, mineral, agricultural, forestry, communicative and health potential, he attempted to map Australia in terms of a new kind of isopleth, which he termed an ‘isokeite’ or unit of equal habitability. Whereas Osborne, Barrett and Hunt had only mapped whether a location


was likely to cause great thermal stress, Taylor sought to balance multiple factors to give the appearance of rational settlement. Though he believed such a map would be useful, he acknowledged it depended “largely on the personal equation of the investigator”.\textsuperscript{119} His conclusion that the highlands of Queensland held most potential and that much of Western Australia was uninhabitable found little favour among the proponents of tropical settlement.\textsuperscript{120} No longer did all of tropical Australia hold equal potential for settlement. At best, a far smaller population than many desired— just 1.4 million people—would likely be possible. (Note that Queensland’s entire population in 1901 was little more than half a million.)\textsuperscript{121} Neither of the only other options that Taylor envisaged was possible: intermarriage with more climatically ‘suitable’ races could not occur under the White Australia policy and, until the south of the country became more densely populated, he saw no prospect of rapid internal migration.\textsuperscript{122}

Initially, Griffith Taylor’s graphic techniques attracted most international attention. “As visual representations of the various effects of climate”, Huntington enthused in the \textit{Geographic Review}, “[…] Taylor's diagrams are much the best yet available”.\textsuperscript{123} Taylor’s contemporaries were not always convinced by his arguments, but many were excited by the imaginative means he developed to express the supposed influence of climate on human endeavours.\textsuperscript{124} Even so, Taylor’s choice of the wet-bulb temperature over the dry-bulb temperature in his climograph surprised many international meteorologists and geographers. This choice was one of the most contested aspects of Taylor’s method, with Huntington, Napier Shaw (of the Meteorological Office in London) and, later, B.M. Varney (of the

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\item \textsuperscript{119} T. Griffith Taylor, “The Settlement of Tropical Australia,” \textit{Geographical Review} 8, no. 2 (1919).
\item \textsuperscript{120} Strange and Bashford, \textit{Griffith Taylor}, 121.
\item \textsuperscript{121} Sir George Knibbs, in \textit{Official Year Book of the Commonwealth of Australia} (Melbourne, Vict.: Commonwealth Bureau of Census and Statistics (Australia), 1914), vol. 7, 180.
\item \textsuperscript{122} Taylor, \textit{The Settlement of Tropical Australia}.
\item \textsuperscript{123} Huntington, "Review of Graphic Representation," 403.
\item \textsuperscript{124} Strange and Bashford, \textit{Griffith Taylor}, 85.
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University of California) all asserting their preference for the dry-bulb temperature as a more pragmatic alternative that gave less weighting to water vapour in the air.  

Although the short introduction to the bulletin by Taylor’s boss, H.A. Hunt, included a general description of appropriate technologies to solve “the housing problem in the tropics”, Taylor seems little concerned with environmental technology in his reports. Nor did Herbertson or Huntington pay much attention to differences in buildings or clothing around the world in the first or second decade of the 20th century. In contrast to physiologists such as Osborne or Leonard Hill, who made recommendations for and against particular types of building interventions and clothing to modify climate, geographers in the tradition of environmental determinism were most concerned with the direct effects of climate on ‘races’ in outdoor environments. It did not matter that in “Civilisation and Climate” Huntington based all of his measurements for ‘human energy’ on factory workers or army test scores, all of which involved indoor work. The outputs for physical and mental energy were directly correlated by Huntington to the outdoor weather at the time. Osborne did advise Griffith Taylor of new developments in refrigeration technology for houses in the United States, but this only merited a footnote in Bulletin 14. Even though Huntington was little interested in architecture and the specific nature of the dwellings that defined indoor environmental conditions, many years later architects became interested in his principles. Long after it became unfashionable in geographical circles to regard climate in Huntington’s terms, his work was prominently cited by Victor Olgyay in his classic work on the method of


126 Huntington did include descriptions of different kinds of housing and clothing in his book “West of the Pacific” from 1923, which was more a rough ethnographic account of his travels around the Pacific than a detailed geographical treatise.


128 “Professor Osborne reminds me that refrigeration is being applied to dwellings on a small scale in U.S.A. In the future it may be possible by this means to insure restful nights in our far north throughout the summer. The problem in many cold regions of increasing the average temperature has, of course, been largely overcome”. In Taylor, The Control of Settlement, 22.
bioclimatic design, which gave it a new lease on life within architectural debate on environmental conditions.129

Medical attention to the settlement of tropical Australia started with the publication of material based on local experience and observation, but it was international attempts to regulate technical battles between management and their workers that prompted research into standards of tolerable thermal environments for the workplace. It may seem strange today that, for a moment, the settlement of tropical Australia seemed to have been determined by the rectal temperatures of a few physiologists in England. Yet through the network of personal contacts, shared publications and education, physiologists and geographers in Australia translated industrial health research into graphical devices to facilitate colonial decision-making. At first topographical maps saw doctors like Elkington attempt to carve out familiar territory, to enable life to go one as before; then the more detailed study by Griffith Taylor suggested that the quantity of highlands was far lower than expected. In between such mapmaking and planning, greater attention was paid to the requirements of agricultural settlers, with work increasingly used as a point of differentiation between male and female settlers in the Australian tropics and their Imperial counterparts in Africa and Asia. As with the close links between geography and tropical medicine, which sought to examine where white Australians could settle at the broadest of scales, tropical medicine’s interest in how best to develop protective devices was—as we will shortly see—a transnational rather than a national affair.

Conclusion

Debates on climate were not just informed by national problems of population distribution or lingering concerns among older members of the medical profession about the acclimatisation of European bodies to new living situations. They were also influenced by debates about the effects on health and productivity of indoor environments in industrial Europe. In both tropical and artificial environments, European bodies were seen, quite simply, to be out of place. In many cases, such as cotton factories or coal mines, the artificial thermal

environment approximated the climatic conditions of the tropics. At the same time as physiologists and geographers in Australia sought to address lingering concerns around questions of productivity, health and longevity for European settlers in the tropics, their counterparts in Britain and elsewhere were addressing the conflicting demands of the ideal physical conditions for industrial processes and the maintenance of workers’ health, comfort and productivity. Physiologists did not attempt to challenge the way materials were extracted or goods produced. As such, they were not initially interested in whether the environment was ideal but whether the environment was safe.

Public health officials and social reformers feared that, where bodies were in an unnatural environment, they were likely to degenerate. This concern for safety, or an interest in the limits of endurance in extreme environments, gave way to debate over what was an ideal thermal environment for productive work. In all of this, architecture figured hardly at all. This was a question of science on the grand scale of settlement; and of the politics and conditions of work. The specific nature of structures was not considered. Yet this debate, in all its abstraction (as far as architecture is concerned), had a decisive, if hitherto poorly understood, influence on the relationship between environmental conditions, both real and imagined, and the demands of home and workplace design.
Chapter 3 Holidays, Homes and Thermal Relief

As discussed in Chapter 1, early 20th century publications on tropical hygiene helped create a common understanding, within tropical medicine, of what features could be expected of tropical housing and what medical and social problems it was expected to solve. Northern Australia, with its large European population of approximately 130,000 in 1901, was considered a curiosity by medical experts in Britain. The housing, however, was of little

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1 In 1901, the population of Europeans in Northern Australia was around 130,000–140,000, with about 125,000–135,000 in northern Queensland and 2,000 each in the Northern Territory and tropical Western Australia. Northern Queensland’s European population was slightly larger than the 120,000 living in Brisbane and slightly smaller than the 150,000 Europeans in British India at the time. Census returns for 1901 counted 142,421 residents of northern Queensland, 4,673 in the Northern Territory and 4,664 in tropical Western Australia. These figures included non-Europeans but excluded Aboriginal and Torres Strait Islanders, who were not included in national census records until 1971. Between 1901 and 1908, estimates of the total Aboriginal population in Australia varied from 41,339 to 150,000. Europeans were a considerable majority in tropical Queensland but a minority in tropical Western Australia and the Northern Territory. In 1901, there were 13,878 Queensland residents born in Asia and 8,877 born in Polynesia. In 1911, when ethnicity was first recorded in the census, 57% of Territorians were non-European. While not all Asians and Polynesians worked in tropical Australia, I estimate a majority did, where they were employed in tropical industries like cane cutting and pearling. Therefore a figure of 125,000-135,000 Europeans living in northern Queensland seems likely. As can be seen from these figures, northern Queensland was by far the most populated region of northern Australia; residents were mostly European and accounted for 30% of the 500,000 people living in Queensland in 1901.

interest. This was largely because research into reforming the tropical house did not begin in earnest in Australia until the end of the second decade of the 20th century, by which time many of the key books on tropical hygiene, including such as those by Schilling and Simpson, had been published (see Chapter 1). Instead a local, informal discourse emerged in northern Queensland during the 1920s, bringing together the interests of medical professionals, political figures and women activists in what a tropical house should do and how it should perform. In the process, new models of tropical housing developed that emphasised economy of operation as well as climatic performance.

As tropical medicine became more confident that, despite the criticisms of geographers (see Chapter 2), northern Australia could support a working white race, its proponents turned their attention to the problems faced by working women and, hence, to the design of the home. A key turning point in Australian debates about tropical settlement occurred in August 1920, when the Australasian Medical Congress declared northern Australia safe for settlement. Delegates believed, however, that the health of women residents required further study. At the Congress, women’s health was presented as largely an environmental problem, as much to do with the social environment of the home as the climatic environment outside. The (mostly male) doctors attending the congress emphasised the need to develop a program of research on tropical housing and resolved to find “the type of domestic architecture which entails the least physical exertion and the greatest physical comfort for the women concerned”. While most medical experts across the tropical world emphasised the need for comfortable housing, the Australian doctors’ additional attention to


fatigue was relatively novel at this time, informed by fears that the hardship of European women’s lives in tropical Australia was a negative marker on ‘civilised society’.4

This was a question not just of class but also of racial prestige, particularly in northern Queensland where over 90% of Australian tropical settlers lived. The Queensland housewife was so scrutinised, as Robert Dixon has noted, as she was “the custodian of the home, the servant of her husband, and, above all the custodian of the race”.5 Unlike her counterparts in exploitation colonies, living in the Australian tropics did not give the European housewife the equivalent of aristocratic status.6 For most settlers in Australia there were no houseboys, maids, gardeners or cooks. Though domestic servants were in demand, not many were available. Across the continent, as the 20th century advanced, fewer women entered domestic service, as opportunities increased for work in factories, shops, restaurants and offices in the main cities. This was only exacerbated by the White Australia Policy which saw many household workers deported from northern Australia and a restricted reliance on Britain as a source of migrant domestic workers.7 Indeed, between 1901 and 1921, though the recorded population of Australia grew from 3.8 million to 5.4 million, the overall number of domestic

4 Alison Bashford has drawn attention to the fact that whiteness in northern Australia was constituted by tropical medicine as working-class whiteness, in contrast to an aristocratic whiteness found elsewhere. While she emphasises the attention by doctors to white working class masculinities, Nikki Henningham has explored how white femininity was constituted in tropical Australia at this time and noted the anxiety among white Australians about how the poverty of women settlers tarnished the image of ‘civilised society’. See Bashford, ”'Is White Australia Possible?,” 261-62; Nikki Henningham, ”'Hats off Gentlemen, to Our Australian Mothers!': Representations of White Femininity in North Queensland in the Early Twentieth Century,” Australian Historical Studies 32, no. 117 (2001): 315.


6 Benedict Anderson refers to the transformation of petit bourgeois Europeans into de facto aristocrats in the tropics as ‘tropical Gothic’, see Anderson, Imagined Communities, 154-57.

service workers declined from 118,703 to 107,824.\textsuperscript{8} Even where servants were available, as Nikki Henningham has noted, few women in tropical Australia could afford to pay them.

Though much of the debate and focus on tropical housing in Australia was gendered, it was not just controlled by male experts or politicians. Women’s groups had begun to organise and to exercise considerable political influence, particularly with regard to women’s health. Australian tropical domesticity was thus scrutinised by doctors and addressed by women’s groups, reframing the problem of the tropical house as a social and not just a thermal one. These networks facilitated the transformation of medical ideas about tropical housing that were emerging in overseas exploitation colonies to address the problems of isolation and lack of domestic assistance about which women in rural Australia complained.

This chapter explores how the project of white settlement in northern Australia created a distinctive discourse on tropical housing design as it came to terms with the white housewife as a domestic worker who received no outside assistance. It argues that the perceived problems of tropical settlement engendered a discourse on tropical housing distinct from that related to exploitation colonies. It developed a new subject (the settler housewife), new institutions (women’s rural organisations), and a new focus for housing (the design of the kitchen) that coalesced around the competitive design of model homes. It shows how the organisation of small-scale design competitions developed the first tentative tropical networks of architects, women’s groups and doctors, thus enabling the translation of medical knowledge relevant to tropical housing into architecture, with women acting as intermediaries. The resulting projects were rarely published in the architectural press, which was dominated by the artistic and intellectual fashions and interests of the profession in the temperate and sub-tropical state capitals. Instead, local architects in tropical Townsville found an outlet in medical publications and the women’s pages of the popular press to test new ideas about climatic design and engage in debate about tropical housing.

The chapter begins by considering how doctors, women’s groups and architects separately framed the problem of tropical housing up to 1920 and how the thermal

\textsuperscript{8} For Australian population figures in 1901 and 1920 respectively see \textit{Commonwealth Year Book}, vol. 15 (Melbourne: Commonwealth Bureau of Census and Statistics, 1908), 1048. For figures for domestic service see Barry W. Higman, \textit{Domestic Service in Australia} (Carlton, Vic.: Melbourne University Press, 2002), 282, Table 6.
performance of the home came to be seen as a problem of particular significance for the welfare of rural women. It then examines the part played by women’s organisations in the design of tropical housing and how such organisations concentrated on providing relief for rural women from the extremes of isolation and climate. Finally, it turns to the efforts of concerned citizens to educate architects and enrol them in efforts to improve tropical housing design. The chapter also shows how these community-led efforts articulated the reform of housing conditions for tropical families as a form of civic progress during the inter-war period.

Early Models

In the early 20th century, most doctors agreed that Europeans required decent housing and decent holidays to endure a stay in the tropics. Even those who were pessimistic about the prospects of European settlement in tropical Australia, such as Mackay’s Dr. G.T. Lloyd (whom we encountered in Chapter 2), were in favour of cheap holidays and cool, economical housing as a panacea for the long-term effects of the climate.9 Two models, which emerged in Australia before the start of the First World War, would continue to define the way medical authorities and community organisations approached the problem of tropical housing well into the 1920s. The first model—cooperative holiday homes for rural women—was not a tropical invention but a proposal for Sydney. The second model—more climatically specific housing—attempted to account for the range of climates found in the state and in the process move away from a state-wide culture of building to a regionalism based on climate.

Across Australia at the turn of the century, rural development was seen as a key nation-building imperative. A variety of vacation schemes that emerged before the First World War were intended to provide mothers and their children with relief from the heat, dust and isolation of rural life in summer. Although targeted at families in the southern states, all these schemes emphasised the healthiness of holidays and the contribution such schemes

made to the future of the nation. Some, like the Goldfields Fresh Air League, founded in 1902 in Western Australia, were intended to restore children’s health by taking them from the rural mining villages to stay in a shared boarding house for a holiday by the coast. Others, like the Seaside Camp Association, founded in 1913 by Alice Currie, proposed to offer subsidised holidays by the sea for rural women and their children. Currie imagined the Seaside Camp Association as a ‘tent city’ and engaged the services of Sydney architect, F. Ernest Stowe, who published his completed scheme in *Building Magazine*.

This was an attempt to promote an ideal of community living and civic participation to bridge the rural-urban divide. Stowe drew up a proposal in 1914 for a site in Narrabeen, just north of Sydney, for the Seaside Camp Association. The huts were kept simple to keep costs down, with each hut to be paid for by individual donors who received naming rights in return. Although never built, the scheme featured a set of 30 wooden huts organised into crescent-shaped rows around a central mess hall (fig 3.1). Unlike later attempts in Queensland, which are explored later in this chapter, Stowe’s design dealt little with the thermal problems of seaside living but focused on the problems of hygienic water supply and waste disposal. While the war shifted public attention away from the plight of bush women to the plight of Australian soldiers, the camp idea re-emerged in March 1923 when Alice Currie suggested the idea of subsidised holiday accommodation for rural women at the first Country Women’s Conference in Sydney. As we shall see, Stowe’s site plan and Currie’s funding model greatly influenced schemes for cheap holiday accommodation for rural women in northern Queensland and formed the basis for built experiments in low-cost housing incorporating medical ideals about tropical living. 11


11 Currie lectured on the seaside homes movement at the first Country Women’s Conference in Sydney, in March 1923, which was attended by a number of Queensland delegates. She also promoted the idea for her ‘model seaside camps’ through a booklet for the New Settler’s League which raised interest in both Queensland and Western Australia. See: "Country Women's Association - Seaside Homes Movement," *The Advertiser*, 28 March 1923, 9; "Model Camps," *Sydney Morning Herald*, November 17, 1924, 4.
The other model saw key officials at the Commonwealth Department of Health and the Australian Institute of Tropical Medicine (AITM) in Townsville using the Department’s building program and the Institute’s research program, respectively, to promote more climatically specific housing models. When the Department of Health decided to develop a system of quarantine, the new stations allowed medical officials, in particular J.S.C. Elkington, Commonwealth Chief Quarantine Officer for Queensland, to test ideas about fine-tuning the climatic design of buildings (and racial segregation) for the specifics of particular climates in Queensland. From 1913, the construction of stations in Lytton (near Brisbane), Cape Pallarenda (near Townsville) and Thursday Island (fig 3.2) presented the Department with the opportunity to suggest designs for both sub-tropical and tropical locations.
An insight into the design rationale for the quarantine buildings comes from Elkington’s close associate, Raphael Cilento:

Each building was separately studied in order that it might be provided with all necessary requirements for comfort, but with nothing that was not strictly essential, and rooms carefully arranged in relation to verandahs &c., in accordance with the
purpose for which they were intended and the hours which they would be in use.
Louvring, shades, vernadahs &c., were provided on the basis established.\textsuperscript{12}
This suggests a pared-back, functional approach to climatic design, which attempted to
provide comfort while still being economical to build. It was an approach that the AITM
would advocate, first under Breinl and then Cilento, but struggle to implement in practice.

Three basic types were developed by the Department of Health and the Public Works
Department (PWD) for officers’ accommodation in Queensland.\textsuperscript{13} At Lytton and Cape
Pallarenda, houses were variations on the ‘four room house’ commonly found throughout
Queensland at the time.\textsuperscript{14} At Lytton, in the sub-tropics, the houses contained only a front and
rear verandah, with bedrooms and living room in the four room core, which was divided by a
central corridor and kitchen and bathroom off the rear verandah.\textsuperscript{15} The houses were only
slightly raised from the ground. In Cape Pallarenda, in the tropics, the verandah extended all
the way around the house, with service rooms located in two of the corners. The house was
also raised about 2.5m from the ground, a distinctive feature of many houses in northern
Queensland compared to those in the south of the state. Lastly, the Thursday Island plan type
involved bars of accommodation organised in a row with open verandahs and breezeways
maintaining separation between the main accommodation and service areas, as shown in fig.

\textsuperscript{12} R.W. Cilento, \textit{The White Man in the Tropics with Especial Reference to Australia and its Dependencies},
Department of Health Service Publication No.7 (Melbourne: Government Printer, 1925). 123.

\textsuperscript{13} See Commonwealth Public Works Branch, Thursday Island Quarantine Station - New Isolation Hospital,
Administrative Block and Caretakers Quarters (Colour Drawing), 1913-1914, J2774, W1654 COL, National
Archives of Australia, Brisbane; Commonwealth Public Works Branch, Cape Pallarenda, Townsville Qld.
Quarantine Station. Sheet No. 5., October 21st, 1914, NAA: J2774, W1144/5, Brisbane; Commonwealth
Department of Works and Railways, Lytton Quarantine Station - Assistants' quarters, June 5th, 1921, NAA:
J2774, W595, Brisbane.

\textsuperscript{14} Peter Bell generalises Queensland houses built between the 1870’s and start of the First World War as
coming in two main types: the two-roomed cottage and the four-roomed house. Peter Bell, \textit{A History of the
Queensland House} (Adelaide: Historical Research, 2002), 18-20. For a broader taxonomy that accounts for rarer
types of houses in northern Queensland during this period see Ray Sumner, "The tropical bungalow: the search

\textsuperscript{15} See NAA J2774, W595
3.4. The Thursday Island plans followed a similar logic to that of many of the tropical house plans described in Chapter 1, suggesting some influence from abroad.

As well as the plan types, J.S.C. Elkington used the quarantine stations at Thursday Island and Lytton near Brisbane to test various devices.\textsuperscript{16} Certain features, such as the stove recess, were used consistently, but the planning and system of ventilation were varied to match the climate. Other features were selected for the climate. Plans for the caretaker’s cottages show ridge ventilation in Lytton, whereas on Thursday Island, where ventilation was considered more important, ceiling vents in each room, connected to a duct, allowed warm air to be drawn out of the roof through a ventilating cowl. Seasonal differences were also considered. In sub-tropical Lytton the buildings had fireplaces to offset cool winters, whereas the buildings for winter-less Thursday Island emphasised semi-outdoor living. This is exemplified by the 3.65m (12 ft) wide breezeway separating two wings of the caretaker’s cottage used as an open air dining room. In their careful use of technical devices the buildings point to a climatic specificity that was often suggested by medical experts but rarely heeded by architects, who tended to assume the climate they lived in was the same for all Queenslanders.

Although the service wing was under the same roof as the rest of the house, this was not servant-less living. While Cilento later promoted the environmental benefits of the quarantine buildings, he remained silent about their organisational planning. The design of the Thursday Island Quarantine Station’s caretaker’s quarters is a case in point. A close look at the plan (fig. 3.4) highlights a strict segregation (also racial in character) between the servant and served areas, suggesting that those working in the kitchen were not expected to live in the main house, only to work there under the supervision of the resident officers. The kitchen itself was directly accessed by two rear porches. Those in the dining room could look into the kitchen but, in order to enter, one had to pass through a ‘servery’. The dining room, while acting as a breeze way, was the in-between space where servant and served interacted. At the same time, it provided those in the ‘master’ wing with multiple means to enter and exit – two

sets of steps leading directly to the dining room and from there to the bedrooms, living room and office. In addition, the two bedrooms had a shared verandah with direct access to the outside. Marked distinctions between servant and served therefore structured the distribution of rooms and the circulation patterns of public servants.

Experiments with Ideal Houses

Medical experts in Queensland were aware of international discourses on tropical housing but some, like Anton Breinl, the director of the AITM, also turned to local architects in Townsville for ideas. Although such encounters might be expected to produce derivative translations of overseas models of tropical housing, architects like Charles Dalton (C.D.) Lynch and his colleague Walter Hunt in Townsville used the opportunity to challenge received orthodoxies. Lynch and Hunt designed the laboratory building of the AITM in 1912 and they advised Breinl on tropical housing. Lynch also produced a plan of an ideal verandah-less tropical house which, as is discussed further below, was published in an article by Breinl and Young in 1919.18 - Born in Austria, educated in tropical medicine in Liverpool and well connected to many of the key people in the field, Breinl had broader experience than Lynch, who was the locally-trained product of the apprenticeship system and unknown outside of Queensland. Hunt, too, had only ever seen practice in Australia and had mostly worked in regional towns. Yet, like a number of architects in Townsville, such as Lynch’s mentor, W.H. Tunbridge, both had a strong interest in climate as a key factor in design and related technical experimentation.19

In May 1919, the Medical Journal of Australia published Breinl’s landmark paper, written with W.J. Young, on ‘Tropical Australia and its Settlement’. The paper was noteworthy primarily because it made a strong, public-health based case for sustainable settlement of the north. From an architectural standpoint, however, its significance lay in the section dedicated to housing design. This contained an unusual plan, provided by Lynch, and


19 Watson notes that Tunbridge and Tunbridge produced a study on designing buildings for the tropics and were credited with introducing brick villas with cavity walls.
some advice for economical housing (between £200 and £600), prepared by Lynch and Hunt, that gave rules of thumb for orientation, room configuration, cyclone proofing and junction detailing to provide ventilation and shade. What was most remarkable about this advice for Breinl and Young, however, was how the architects tried to imagine tropical housing without its most typical feature, the verandah.20

Questioning the verandah in a medical publication was highly unusual, as almost every writer on tropical hygiene at the time advocated its use in the tropics (see Chapter 1). Lynch himself was a critic of doctors who thought that the verandah was “the panacea for all tropical house troubles”.21 Instead, in Breinl’s and Young’s article, Lynch and Hunt gave pragmatic reasons for dispensing with the verandah and suggested how it could be reimagined. For economical housing, Lynch and Hunt thought that deep front verandahs and side verandahs could be avoided when internal space was at a premium. Instead they argued that “large rooms and limited verandah space are infinitely better than small rooms and wide verandahs”.22 They also suggested that the verandah was redundant when masonry cavity wall construction was used in more expensive housing as the outer wall of the cavity took on the role of shading the inner leaf. This idea was further developed in a sketch of a verandah-less house that Lynch prepared for Breinl’s and Young’s article, shown in figure 3.5.

Instead of placing a core of accommodation surrounded by a verandah, Lynch distributed the accommodation to the corners, placing the verandah in the centre of the house.23 Lynch’s plan showed a square planned house, laid out on a nine-square grid, with rooms in the corners. This left a cruciform passageway that ran through the centre of the house and formed an opening in the centre of each wall. Labelled an ‘internal veranda’ [sic],

20 This was not the first time that architects had attempted to consciously do away with verandahs. Peter Scriver has examined Major J.G. Medley’s critique of Anglo-Indian architecture, in particular his 1865 verandahless barrack design for Upper India. Medley thought verandahs were impractical and useless in the hot-arid plains. See Peter Scriver, "Imperial Progress: On the Impracticality of Problem-Solving in Colonial Indian Building," Fabrications 11, no. 2 (2001): 27-31.


23 Breinl and Young, “Tropical Australia and its settlement,” 401.
this cross-shaped breezeway inverted the organisation of the four-room house in northern Queensland, bringing the liminal spaces to the core and the core spaces to the edges.

Lynch gave a more detailed account of his design intentions the following year in the Townsville Daily Bulletin. He pointed out many of the perceived weaknesses of the external verandah which, he believed, his internal verandah solved:

External verandahs, that to many minds, are the panacea for all tropical house troubles, says Mr. Lynch, have been dispensed with. In lieu of them, internal verandahs have been introduced, thus obviating glare, and incidentally doing away with the necessity of lattice, verandah sash work, louvres and blinds. As compared
with the usual bungalow, this arrangement reduces the cost of mosquito proofing by 100 per cent. Lynch expected the design, though only a concept sketch, to cost over £1000, considerably more than the average cost of a worker’s home at the time. At the same time, Lynch gave the impression that this was a more economical solution, giving better thermal and visual performance than a typical house while still protecting against insect-borne disease. It was only economical if one considered the construction cost per square meter which, at £2.94/m² (£0.27/sq ft), was similar to that of a ready-to-erect timber house. Lynch’s house, however, was enormous, with a gross floor area of 340 m² (3656 sq ft). This brought its overall cost to over £1000, well beyond the reach of the average worker, who was more likely to spend between £200 and £400 to build a house at this time. Although Breinl’s and Young’s article included a list of suggestions by Lynch and Hunt for houses between £200 and £600, none of these was illustrated. Apart from eliminating verandahs, the list contained few suggestions for cutting back on cost. Only the more expensive design was illustrated, suggesting that the doctors in the AITM were more interested in novelty than in addressing questions of cost in detail. The general preference of doctors—to dwell on the climatic performance of buildings but gloss over the economic implications for construction—would become a pattern that hampered many of their efforts to enact change in how buildings were designed in the tropics during the 1920s.

At the same time, the power of Breinl’s networks, aided by the novelty of Lynch’s design, enabled such architectural experiments in tropical design to reach a medical audience. After its publication in the Medical Journal of Australia, the article was republished several times.

24 "Tropical Architecture."

25 In December 1918 Brown and Broad timber merchants in Queensland were selling the Carpentaria ready to erect Newstead home for £760. It measured 14.94m x 17.07m (49 ft x 56 ft) with a gross floor area of 254.9m² (2744 sqft). This works out at £0.28/sqft or £2.98 m². For layout and costings see Brown & Broad Limited, "B & B’ Newstead homes : a catalogue of ‘ready-to-erect’ homes," (Brisbane: H.J. Diddams & Co., 1918), 10, 23.

26 Between 1916 and 1917, 90% of all dwellings constructed under the Workers Dwelling Act 1914, which provided affordable homes for those on low incomes in Queensland, cost between £200 and £400. For a breakdown of the distribution of dwellings and costs see Norman James MacLeod, Statistics of the state of Queensland for the year 1919 (in ten parts and index) (Brisbane: Government Printer, 1920). 29G Table 30.
times, reaching an international audience through the *Annals of Tropical Medicine and Parasitology*. It was picked up by the *Indian Medical Gazette* as a suitable model for Calcutta flats and also included as a curiosity by Cilento in his book *The White Man in the Tropics*. Yet the house was never published in the architectural press, which only began to exhibit a systematic interest in tropical architecture towards the end of the Second World War.

Surveying the Tropical Home

During the early 1920s, tropical settlement, both along the coast and in the interior, came under intense scrutiny by the Commonwealth, which sought input from both medical professionals and settlers themselves. Medical professionals were asked to pass on their experience of the prevalence of particular tropical diseases and other influences on community health. At the same time, the lifestyle, material conditions and domestic practices of rural settlers were examined by a group of federally appointed inspectors who reported back to the Department of Health, which was formed in 1921. In 1920, prior to the Australasian Medical Congress, the Sub-Committee for Tropical Housing, led by the Federal Director of Quarantine, J.H.L. Cumpston, posted questionnaires to every medical practitioner resident north of Rockhampton, published a copy in the *Medical Journal of Australia* and sent more copies for distribution by State secretaries in Fiji, Papua and German New Guinea, New Zealand and the remainder of Australia itself. Although the sub-committee members were disappointed that they received a response rate of only 10%, they triumphantly claimed that “analysis of the returns showed a markedly favourable opinion on the suitability, climatic


and topographical, of North Queensland for successful implantation of a working white race.” Few practitioners indicated that tropical diseases such as malaria were affecting the health of their patients. On top of that, the traditional medical fears of acclimatisation—that it affected women’s fertility and caused long-term degeneration—were not reflected in the survey returns. This positive appraisal of the suitability of the north for white settlement was backed up by the AITM’s own statistical inquiries, in a paper also presented at the congress. The Sub-Committee claimed that respondents were most concerned about alcoholism, diet, poor clothing, housing conditions, and hygiene knowledge.

Although the congress endorsed the view of the Sub-Committee on Tropical Australia—that there were “no insuperable obstacles in the way of the permanent occupation of Tropical Australia by a healthy indigenous white race”—much of the discussion centred on whether living conditions in tropical Australia were suitable for women and children. Dr. A.T.H. Nisbet of Townsville, Sir James Barrett of Melbourne, Prof. Henry Priestley of Sydney University and Dr. D.D. Paton all drew attention to the thermal conditions in which women were working and, while they differed in their opinion as to whether this was


32 For the thinking in London on acclimatisation around this time see: Andrew Balfour, "Problems of Acclimatisation," The Lancet (1923); Leonard Hill, "Notes on Tropical Climate and Health," in Notes on Housing and Health in the Tropics, ed. Andrew Balfour (Port Moresby: Edward George Baker Government Printer, 1921).


35 Dr. A.T.H. Nisbet in particular believed climate was the main inhibitor to mass settlement, and went to considerable length to portray his experience of the everyday difficulties of women and children living in the tropics. He emphasised the thermal conditions of dwellings, the separation of families from their children, the likelihood of social degeneration if women were to adopt kimonos, how climate prevented women and girls from fulfilling ‘their duties’. For Nisbet the problem was one for women and children, not men.
fundamentally an economic or a climatic problem, all expressed the view that, generally, housing conditions were, at that time, unacceptable in the tropical north.

The discussion of acceptable conditions was premised on two beliefs: that women had a duty to maintain the running of a household; and that the physical conditions for domestic work determined whether or not women would remain in Queensland. A married woman, according to one Dr. E. Humphry of Townsville, was little more than a “slave and drudge” and was expected to “work, wash up, get the children ready for school, wash their clothes, nurse the baby, act as incubator and wife.” Nisbet painted a similar picture, claiming that women were expected to do all of the work at home as their children did not aspire to be domestic servants. For Nisbet the main issue was the climate, since, while mothers could undertake household work in winter without any problem, “young married women have no right to be doing domestic washing with the temperature at 90 degrees in the shade, nor cooking in a roasting kitchen at 110 degrees, the humidity reaching close to the saturation point and the iron roof nearly touching her head. Nothing but the maternal instinct and domestic devotion would make them do it for a moment. They will not do it as domestic servants as pay.” Nisbet only questioned why women put up with such conditions, but did not question the duties themselves. Though he thought that women ought to have some help with housework, he acknowledged that home help was difficult to procure, whatever financial incentive might be offered.

As noted previously, the demand for servants did not go away. Rather, as the labour historian Barry Higman has noted, the availability of people in service greatly decreased. Part of this was a consequence of the Immigration Restriction Act of 1901. Domestic servants in the north of Australia were often of Melanesian or Chinese origin and the Act prevented many from staying on in Australia. British servants were not affected but, with Britain experiencing its own servant crisis, few domestics were interested in migrating to Australia.

36 "Tropical Australia," 40.
37 Tropical Australia," 55.
38 Higman, Domestic Service in Australia, 43.
At the same time, a wider range of options for employment for young women was developing in Australia, with the consequence that fewer were attracted to a life in service.

As servants were considered effectively unavailable, and with the family’s womenfolk expected to perform all household tasks, the debate became centred on the domestic conditions in which women were to work. These conditions were discussed in both physiological and psychological terms, and knowledge about women’s working conditions reflected quite different expectations.40 While male physiological reactions were explained in terms of the body’s reaction to the external climate (assuming outdoor labour), interior temperature was taken to be the chief indicator of how suitable tropical life was for women (assuming indoor domestic labour). It was used by Nisbet, Priestley and Barrett to explain not just the difficulty of performing housework but also the likelihood of ‘neurasthenia’ or nervous breakdown and general ‘debility’. During the discussion at the Congress, Cumpston was less convinced that either neurasthenia or a lack of servants were issues specific to the tropics. Nevertheless, his own report to the government emphasised that:

[…] probably no phase of the Tropical Australia question is more important than the study of the conditions under which the wives and mothers of families carry on their domestic activities. It is beyond doubt that a wisely conducted investigation, with the erection of a limited number of experimental houses of various designs and materials, will succeed in demonstrating the type of domestic architecture which entails the least physical exertion and the greatest personal comfort for the women concerned.41

What is of interest is how Cumpston framed the problem of women settling tropical Australia as one with an architectural solution. Buildings and materials were to be tested for how efficiently they allowed women to work at home and the level of comfort they could offer. The house was reduced to a comfortable domestic workplace. Rather than the house in the

40 Alison Bashford has drawn attention to how medical investigations about White Australia concerned not only race, but also gender and class. In particular she points out the ambivalent masculinity of the white worker, who was not the driven overseer dominating colonial subjects but was himself dominated by industrial captains and expected to work efficiently. While she notes that tropical medicine was closely aligned with commercial interests, she also highlights how the types of investigations used in Australia were different for men and women. Physiological and biochemical studies were only performed on male subjects, mostly in laboratory or work settings, while women were studied only through surveys and statistics. See Bashford, "Is White Australia possible?" Race, colonialism and tropical medicine."

tropics being a stage of display, it also becomes a place of industry. In maintaining a household, women could not expect any assistance from others (either servants or, in many cases, their husbands). Instead the house, through its architecture, was expected to protect women from fatigue and create conditions that were pleasant to work in.

Housing was a contentious issue for the (mostly male) delegates at the congress as they believed that, if living conditions were so unattractive to women, then the long-term settlement of the tropics would prove impossible. As discussed in the previous chapter, it was not the first time such beliefs had been aired; Dr. G.T. Lloyd had already reasoned along similar lines to the press and parliamentarians in 1905 at Mackay.42 Similarly, in 1913, the Commonwealth Meteorologist, H.A. Hunt, had noted how poor housing conditions in the tropics affected women more than men.43 It was at the Australasian Medical Congress, however, that the connection between settlement and women’s living conditions was first debated extensively as a prerequisite for white settlement per se. According to Nisbet, the “tropical languor” that came with indoor work in northern Australia produced a longing among women to return to cooler climates. Most delegates agreed that men could maintain their health in the tropics but believed that women’s living conditions required further scrutiny in order to understand how best to develop a ‘scientific’ scheme of settlement.44

In April 1921, just after releasing his report, Cumpston lobbied his minister to appoint three female investigators to spend two years inquiring into the factors that inhibited or promoted the settlement of white women in tropical Australia. He argued that “it is evident that the development of Tropical Australia cannot take place, if there be not an adequate proportion of women amongst the residents, and it is equally evident that the continued residence of women under tropical conditions is entirely a matter of health.”45 Cumpston


43 "Women in the Tropics," Examiner, April 19, 1913, 6.

44 In his report Cumpston did not draw any attention to the considerable dissent at the meeting but noted that future settlement was dependent on further research into “the practical details of any scheme of settlement”, in particular women’s living conditions. Cumpston, "Tropical Australia - Report of the Discussion at the Australasian Medical Congress at Brisbane, 27th August, 1920," 5.

45 The Director-General of Health to Minister of Health, 12 April 1921.NAA: A1928, 447/1.
proposed limiting the investigation to the study of domestic architecture (in particular kitchen environments), the preparation of food, working hours and the availability of domestic servants, and how such factors affected women’s health and the development of northern Australia. Though the minister passed over Cumpston’s proposal in April 1921, the idea was picked up again in June 1923 by the new director of the AITM, Raphael Cilento.46

Cilento was an ambitious and forthright enthusiast for tropical white settlement and would, along with medical administrators J.S.C. Elkington and J.H.L. Cumpston, shape most of the medical arguments and institutional structures that framed tropical settlement as a problem of applied public health. Cilento saw potential in the momentum behind the expansion of the Queensland Country Women’s Association (QCWA) to promote the views of the Institute and to gain ready access to people’s homes. The QCWA had been founded in Brisbane on August 10, 1922, and established a presence in northern Queensland when its Northern Branch was formed in Townsville on June 7, 1923.47 It was set up as a non-political, non-sectarian organisation, open to “all women over 18 years of age outside the Metropolitan area, and all women inside the city of Brisbane, whose income was derived from the land.” Its principal aim was “to improve welfare and conditions of women and children in the country districts.”48 Cilento’s wife, Dr. Phyllis Cilento, was one of its founding members in Townsville. She shared many of her husband’s beliefs about the need to better adapt housing and clothing to climate and campaigned for better facilities for rural women to overcome isolation.49 Her involvement facilitated connections between the AITM

46 An annotation on Cumpston’s 12th April letter to the Minister noted that the Minister directed Cumpston to postpone until the next financial year’s estimates. In July, the treasurer, Sir James Cook, claimed that the estimates predicted a deficit of 14 million pounds less any surplus unless spending was curtailed. It seems likely that, given the pressure on the government to reduce costs, this put a hold on Cumpston’s proposal. "Federal Finance," Rockhampton Morning Bulletin, July 8, 1921.


49 On Cilento’s beliefs about housing and clothing see Phyllis Cilento, My Life (1987), 58. On Phyllis Cilento’s presentations to the QCWA see, for example, Phyllis Cilento, "Women in the Tropics," Townsville Daily Bulletin, August 6, 1923.
and the QCWA and the tacit promotion of the AITM’s agenda. A few weeks after Phyllis Cilento helped found the northern branch of the QCWA, Raphael Cilento was asked by the association to produce pamphlets on hygienic living. He, however, also saw this as an opportunity to trial the running of a ‘sociological unit’ in Queensland. In a letter to Dr. J.S.C. Elkington, his superior at the Division of Tropical Hygiene in Brisbane, he hinted that this could be done unobtrusively:

> It appears to me that this would be a magnificent opportunity to take advantage of a popular movement during the stages of its early and rapid spread, and to impose upon it an addition to the programme which might orientate the party towards the Institute and the Division, without identifying us in any sense with the Association other than as a benevolent mentor for this or any similar activity.50

As the countrywomen began to form their state-wide body, Raphael Cilento considered the value of this network to public health not in relation to how the QCWA’s aims aligned with those of the Institute but in terms of how the Institute of Tropical Medicine could mould the aims of the QCWA itself. As well, rather than strictly adhere to the QCWA’s request for pamphlets, Cilento wanted access to its network of members to both spread propaganda and collect data from members. This was as much about managing the dissent among medical experts about the practical feasibility of tropical settlement as it was about managing and reorienting the lobbying efforts of countrywomen.

**First Competition**

In the 1920s, the design of the tropical house in Queensland was particularly controversial, as state-promoted ‘tropical colonisation’ by White settlers was thought to rest on the welfare of the servant-less housewife and, hence, on a relatively untested question in the European tropical experience. The medical profession, Queensland Country Women’s Association and government all believed that housing reform was necessary and that the health of European families depended on the climatic suitability of their housing. Separately, between 1921 and 1922, Queensland’s Governor, Sir Matthew Nathan, and the QCWA had called on the PHA to offer public advice on the character and planning of the ideal house for tropical Queensland,

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50 R.W. Cilento, Letter to the Directors, Division of Tropical Hygiene, Brisbane, June 28, 1923, NAA:SP1061/1, 786 National Archives of Australia, Sydney.
in a bid to rid the state of what Nathan described as the “wretched little wooden and corrugated iron shanties”.

It would take another eight years and a number of false starts, however, for any design to be produced. The story of how these initial calls for a model house eventuated in a design competition in 1930 may at first seem parochial, but is significant as it helps answer the question of how the debate about tropical housing during the inter-war period migrated from the field of public health to the field of architecture. In the process, it documents the slight deviations in the purpose of the competition and the contingencies upon which these rested. Far from a heroic story, it highlights the mundane and often awkward struggles for professionals to appear publically relevant.

On September 14, 1922, M.H. Brydon, a committed Taylorist and Inspector for Women’s Work with the Department for Public Instruction, came to the Brisbane Women’s Club (BWC) with a proposal. Just over a month had passed since the club hosted the inaugural Country Women’s Conference. In light of the session on ‘The Housing Question’ at the conference, she asked her privileged female audience to fund a design competition to “decide the type of house most suitable for tropical or arid districts”. The competition would be open to all and require the submission of a sketch plan. Although she noted that conditions could be decided on in the future, the BWC would maintain “the right to publish in the daily Press, the winning or any other sketch”. In the press reports of Brydon’s speech, she clearly articulated her ideas about the potential of competitions to generate interest and to educate women about house design. The links between race, nationhood and womanhood were all made explicit in her speech, which touched on not just women’s roles in efficiently planning houses and the cultivation of femininity in the “daughters of the race” but also warned against the “irresponsible production of the unfit as a sin against the nation”. Brydon’s eugenic ideas centred on a vision of women as efficient homemaker-nation builders, and the tropical house in both humid and arid regions was seen to be most in need of reform. While she sought to create publicity for her club and ensure that white women served their nation, Governor Nathan had other ambitions.


52 M.H. Brydon, “Daughters and Homes,” Brisbane Courier, September 21, 1922, 12.

A former military engineer and governor of Sierra Leone, the Gold Coast, Hong Kong and Natal, Nathan got wind of Brydon’s proposal, which was given a full write-up in the *Brisbane Courier*. He not only supported the competition, but attempted to elevate its standing, enlist overseas expertise and transfer responsibility for its organisation away from the BWC. As a governor with a strong interest in promoting British immigration, he was also a patron of the QCWA, the Queensland Town Planning Association (QTPA) and the PHA. Such connections would see Nathan act as a covert mediator, shifting the competition from a women’s concern to one of public health and, ultimately, one of town planning and architecture.

At the beginning of October—the start of ‘Health Week’, a public health ‘campaign against ignorance’—the Governor endorsed the competition and pledged 10 guineas towards a 100 guinea prize. Nathan’s proposal for a competition was driven by questions of expertise and innovation. Not only did he assume that large prizes would attract competent architects, but that ‘foreign experience’ was also required to brief the competitors. Drawing on his own colonial expertise, he believed entrants needed to know what was happening in tropical housing elsewhere in the British, American and Dutch colonies where the problem, he thought, was “more scientifically studied” than in Britain’s “White Dominions”. In addition, he set out his selection criteria for a jury, which ought to comprise of “an architect and two doctors of recognised pre-eminence: one of the latter should be a woman and all three should have knowledge of life in the tropics”. His call for a female representative on the jury was novel at this time, as neither a large international competition like the design of Canberra in 1916, nor a national one such as the design of the ANZAC Memorial in Brisbane

54 "Tropical Life: The Wretched Little Shanties,":7-8; Brydon, "Daughters and Homes." 12.
56 A guinea was equivalent to £1,1 shilling. "The Housing Problem," *The Brisbane Courier*, 18 October 1922, 4.
57 ""Health Week,"" *The Brisbane Courier*, October 3, 1922, 7.
58 “Health Week,” 7.
in 1928 had any woman on the jury. 59 Although Nathan echoed Brydon’s earlier call for female representation on the jury, his specification that she must also be a doctor effectively ruled out the possibility of such representation. He also stacked the assessment of the competition in favour of the medical profession, in effect forming a medical jury to assess what was seen to be a physiological design problem.

Through Nathan’s endorsement of the competition in Health Week, he shifted the responsibility for organising the competition away from the BWC to the Queensland branch of the Public Health Association (PHA). That Nathan sought to do so is not surprising, as he had already urged the Queensland branch of the PHA to come up with a design for a tropical house at their inaugural meeting in August 1921. 60 Although nothing had been done in the intervening period, Nathan’s Health Week speech in October 1922 gave renewed momentum to the PHA. That month, a sub-committee, which included Brydon, was formed for the competition and some progress on funding was made with a further pledge of 5 guineas from the Australian Sugar Producers Association. 61 It was clear from the press reports that the organisers hoped that such pledges would spur other organisations and members of the public to fund the competition.

The question of funding would haunt the first attempt at a design competition. In December 1922, when further details emerged in the press about the competition, the organisers had doubled the first prize from 100 guineas to £200 and proposed a total prize fund of £350. This was a huge prize, only slightly less than the 250 guinea first prize offered by the Commonwealth government for the Port Said Anzac memorial competition being held at that time. 62 To put this in perspective, the Port Said Anzac Memorial was to cost £11,000, whereas a small worker’s cottage in Queensland averaged £442 at the end of 1922. 63 Even in


60 "Tropical Life: The Wretched Little Shanties," 7.


62 "Monument to the Soldiers of the Australian and New Zealand Forces," ABJQ 1 no.2 (August 1922), 21.

63 Ibid., 35; "Workers' Dwellings - 9055 Completed - Comparison of Costs," ABJQ 2 no.16 (October 1923), 20.
1927, when the Queensland Institute of Architects (QIA) drew up guidelines for running competitions, they recommended a total prize fund of “roughly about a ½ and 1 per cent. of the value of the work”.64 In contrast, the PHA was offering a prize fund worth approximately 80% of the cost of a small worker’s cottage.

Nathan’s call for a 100 guinea prize and the committee’s later decision to increase the prize fund to £350 changed the role of the organisers from that of competition promoter to competition fundraiser. Although the committee could generate press interest, its members greatly misjudged their ability to solicit money. At the end of the year they were woefully short of the £350 target, with pledges only totalling 15 guineas. Despite widespread press coverage throughout Queensland over the Christmas holiday period and further calls for funding by the Governor in May 1923, by October 1923 the competition was dead in the water. The PHA’s honorary secretary, E.R.B. Pike, noted that “the effort so far has been a dud”, claiming that the lack of interest shown was “proof that the average individual has little realisation of essentials”.65 This did not, however, stop medical experts or Nathan himself from trying other strategies to develop a model tropical house.

As dreams of a competition faded away, metropolitan medical experts continued to argue that alternative models of tropical housing were required. In early July 1923, in a widely reported attack on Queensland’s housing standards, the Melbourne physician Sir James Barrett expressed to an audience of the Victorian Public Health Association in Melbourne his shock about house construction in Queensland.66 He noted that many houses in Queensland were similar to those built in temperate Australia and suggested that the overheating of such buildings, when they were imported to the tropics and subtropics, resulted in “nervous exhaustion, and probably anaemia” among women. Instead Barrett recommended the housing found in Panama. His criticism was not well received by the Queensland press, Brisbane’s Daily Mail claiming he had used outdated examples. It did, however, maintain the pressure for change.

64 “Information Regarding Architectural Competitions,” ABJQ 6, no. 63 (September 1927), 15.


On July 19, nine days after the *Daily Mail* reported Barrett’s criticism, Sir Matthew Nathan wrote to the PWD about an investigation into tropical housing in Queensland. In response, the department drew up a set of nine plans and, at the end of November 1923, sent them to the Institute’s director, Raphael Cilento (now director of the AITM), for advice on their climatic suitability.

Cilento reviewed the plans, providing both a critique of the design and general notes on building in the tropics. This medical analysis of the PWD’s plans (which since seem to have been lost) emphasised ideal relationships between different functional spaces. The bathroom, guided by determinist notions of appropriate lighting, ventilation, cleanliness and efficient maintenance—all of which were directed to the elimination of disease and discomfort—was expected to be convenient to any sleeping space, whether that was a bedroom or sleep-out verandah. At the same time, occupants were not to pass through the dining room to access a bathroom. He reluctantly agreed with the general wisdom that stairs were problematic for housewives and should be avoided. “While it is admitted that this is usually owing to a faulty general routine on the part of the housewife herself, it is nevertheless an important attitude of mind.”

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67 Information on Sir Matthew Nathan’s interest in the PWD’s tropical housing design has been gleaned from PWD letter registers and mention made by Quinn about the governor’s interest in the designs when Quinn wrote to Cilento on 26 November 1923 (see reference below). Unfortunately, despite extensive searching, it has not been possible to locate Nathan’s correspondence to the PWD or Cilento about the matter. For basic information about the letters (dates, subject titles and authors and addressees) see Public Works Department, Works Department - Card registers of general correspondence. Staff cards, miscellaneous, inter- and intra-departmental correspondence, 1909-1927 2 of 5, 1909-1928, WOR/B58, Queensland State Archives, Brisbane.

68 R.N.F. Quinn to R.W. Cilento, 26 November, 1923, NAA: SP1061/1, 128, National Archives of Australia, Brisbane.

69 Despite extensive searching I could not find plans developed by the PWD in either the Queensland State Archives or National Archives of Australia in Brisbane, Sydney or Canberra. Only Cilento’s notes on the matter have been found in the National Archives of Australia in Sydney. For basic information on correspondence between PWD, Governor and Cilento see PWD card registers of general correspondence, 1909-1927, 2 of 5.

away from the sun. Despite the forcefulness of these recommendations, Cilento did not venture to specify exact dimensions: How close was dangerous, how far was inconvenient?

The remainder of Cilento’s criticism emphasised the presence or absence of particular features. It was viewed as a problem that many of the bedrooms did not allow for cross ventilation, and Cilento thought a built-in linen press was a good idea. He also contended that screening verandahs was not enough to prevent mosquitoes entering the house—external doors were also required to be mosquito-proof. Cilento was not impressed by any living rooms or kitchens that did not have a verandah; he had clear ideas on details such as shading placement and type. Again, the guidance came without specific dimensions for such devices.

Overall, the consistency between Cilento’s survey, writings on ideal housing, and critique of the Department’s plans demonstrated a strongly-held, persistent view on the ideal tropical house. While Cilento recognised that the plans were influenced by questions of cost, construction and tradition, the extent and detail of his criticism revealed large gaps in knowledge about tropical design between the PWD, the AITM and, by extension, the knowledge base offered by the Queensland Country Women’s Association.

Although Cilento’s report formed a chapter on tropical housing in his service publication *The White Man in the Tropics*, it seems unlikely that the outcomes were highly innovative since, in June 1925, Matthew Nathan lobbied the QTPA to look further into the design of a suitable tropical house.71

**Disguising the Survey**

The experience of Raphael Cilento and the AITM shows how individual doctors used the Department of Health’s building projects and the QCWA’s network to test their ideas about tropical living. Despite their ideas on tropical construction appearing in publications for the medical profession and general community, the work of these doctors was little known in the architectural profession beyond those in the PWD who had access to Cilento’s reports on

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their plans. The AITM was not, however, the only organisation with an interest in exploring tropical housing. Parallel to its efforts were those of the QCWA itself. Like the AITM, the QCWA attempted to develop built solutions that would alleviate the thermal and emotional stresses of living in the tropics. Whereas the emphasis for the AITM was in housing government employees, the Country Women’s Association instead developed holiday homes to offer temporary respite for poor settler families—exploring architectural solutions in a social program beyond the home rather than within the home itself.

The endeavours of each organisation are significant because, in both cases, the buildings they helped develop dealt with climate and the question of domestic service. It is worth remembering that the general attitude of the medical profession to tropical living, aired at the aforementioned Australasian Medical Congress in Brisbane, was that white settlers would be best able to survive in the north if they could both afford a comfortable house and take regular holidays. This set the scene for developments over the next couple of years. Countrywomen were now a recognised demographic, with supposed illnesses and threats. But the project of northern settlement, which had caused controversy at the 1920 medical congress in Brisbane, met with pockets of resistance.

While the AITM paid most attention to developing solutions for comfortable homes, the QCWA made holidays more affordable for its members, with cheap railway fares and accommodation. In Townsville, both organisations shared an architect, C.D. Lynch, who worked in partnership with Walter Hunt from 1911. After the partnership ended in 1921, Hunt went on to design Anton Breinl’s house in 1923, while Lynch went on to design holiday homes in Bowen and Townsville for the QCWA.72 At this time, countrywomen became a recognisable subject for study but it was only in 1922, with the formation of the QCWA, that they became formally linked together as a recognisable institution, organised into divisions and branches.

The AITM proposals for tropical houses were radical in both their planning and performance but they were ultimately undone by questions of cost. As we shall see, the AITM paid little attention to issues of construction cost and the financial situation of the targeted settlers. On the other hand, the holiday homes developed by the Country Women’s

Association paid close attention to cost, had an innovative funding model and were realised in multiple locations. They also developed two distinctive typologies: the self-catering chalet and the serviced shared home, with chalets the preferred option in northern Queensland. The QCWA’s activities in fact helped further some of the work of the AITM. With Lynch acting as a bridge, ideas developed for tropical housing by the AITM were translated in some of the holiday homes developed by the QCWA, so that the holiday homes became as much test beds for the AITM’s ideas on housing as places of temporary relief.73

Cilento was aided by his wife in this project. Dr. Phyllis Cilento, who was both a prominent member of the QCWA and advocate of improved maternity care, ensured that many of the issues of concern to the AITM, such as the reform of people’s habits to match the climate, were on the agenda of the QCWA’s conferences. In fact, in July 1923, Phyllis Cilento helped gain the backing of the northern members of the QCWA to approach the AITM to appoint a female investigator to report on rural women’s living conditions, give lectures on the ‘problems of tropical life’ and issue pamphlets that addressed these problems.74

Cilento’s request for pamphlets in 1923 provided the AITM with access to this group, particularly—though the QCWA’s expanding network—to the very homes and people that the Department of Health sought to both protect and reform. In short, the 1920 Medical Congress set out specific problems attached to the general question of tropical settlement of Europeans that the AITM had been looking at for some time. Though doctors lacked the information to address these problems, the new networks of the QCWA offered an

73 It is difficult to comprehensively assess the impact of the AITM on the design of housing by the Queensland Public Works Department or Department of Mines and Railways. In general it would appear that there was minimal impact and that the AITM were not much impressed by the environmental performance of the department’s standard houses. When Nurse Gorman undertook her sociological survey of North Queensland, she deliberately altered her schedule to interview householders in Chillagoe, where the local health inspector considered newly built dwellings by the State Government to be uninhabitable. Although Cilento was optimistic in 1925 that the demand for comfortable dwellings would ensure a higher general standard of environmental performance in the future, he was highly critical of the general ignorance of the building industry about designing for climate See Gorman to Baldwin, 23 July 1924, NAA SP1063/1, 786.; Cilento, *The White Man in the Tropics with Especial Reference to Australia and its Dependencies*: 124.

opportunity to gather data. As discussed below, Anne Gorman became a bridge between the two organisations, travelling and conducting surveys, all the while lecturing on values the AITM had been fostering and promoting for over a decade. Behind all of Gorman’s acts sat Raphael Cilento, shaping what she said. Cilento’s connection to the QCWA allowed the AITM not only to carry its message to members through lectures and pamphlets but also, through access to countrywomen’s homes, to monitor whether rural women were living up to the Director’s ideals on tropical living—an ordered lifestyle of industrious labour where customs were adapted to climate so that houses were thermally and spatially efficient, clothing was loose, diets were moderate and the day was punctuated by regular exercise.75

Lecturing, Cilento argued, would allow a visiting investigator to travel freely and, being hosted in exchange for lectures, it would be economical.76 Rather than go himself, he selected a nurse, Anne Gorman, an accomplished horsewoman who had grown up in the countryside and had some experience of quarantine nursing.77 Cilento wanted ‘Nurse Gorman’ to engage directly with branches in the network by giving lectures. Such gatherings could be used to solicit access to members’ homes in order to collect information about their living standards and knowledge of hygiene, infant welfare and domestic science. Cilento maintained tight control, preparing notes for Gorman on the topics, subjects and detail of the lectures. His proposed topics paralleled the set of variables he expected to be measured. The prepared talks focused on the topics of food, work and recreation, housing and house management. In terms of housing and house management they considered:

a) the house environment
b) the house itself – climate in relation to housing
c) the relation of the individual to climate
d) house management – time saving and temper saving devices
e) the preservation of food – the preparation of food,

75 For a fuller description see Cilento, The White Man in the Tropics: 106-24, 45-63.
76 R.W.Cilento, Letter to the Directors, Division of Tropical Hygiene, Brisbane, June 28 1923.NAA: SP1061/1, 786.
77 A.M.Gorman to Freda Barge, 22 March, 1921, NAA: A1928, 447/1, National Archives of Australia, Canberra.
f) comfort devices in the home,
g) personal clothing – the clothing of children.78

If the lectures set out the normalised ideal, the survey form he developed was to measure how close to the norm the subjects conformed. Cilento listed the set of variables to be measured in a memorandum to Gorman in January 1924.79 Out of 29 initial questions, 20 related to the kitchen or its contents. Of the remainder, three related to diet, understanding of domestic science and infant welfare, while the rest dealt with the supply and disposal of water to the house, the general construction of the house and the appearance of the yard. Cilento’s questions are instructive as they enable us to see what Public Health Authorities valued most in the house. The size and scale of the kitchen was not measured; consideration was only given to its relationship and proximity to other service areas, its environmental features and food storage facilities.

For the purposes of measurement, the kitchen stood for the whole household. It was in the design of the kitchen that the distinctive approach of public health officials to tropical housing was most apparent. Cilento’s *White Man in the Tropics* is unique among tropical hygiene manuals for the attention it gives to the kitchen, which did not figure as a design problem in any other manual of its kind. While, in general, Cilento’s writing on housing borrowed heavily from Balfour, on this matter he departed not only from Balfour but from everyone else.80 Claus Schilling, for instance, saw the bathroom as the most important room in the house, while T.F.G. Mayer tried to eliminate the concept of rooms to maximise airflow

78 R.W.Cilento, Letter to the Directors, Division of Tropical Hygiene, Brisbane, June 28 1923.NAA:SP1061/1, 786
79 Pers. corr. R.W.Cilento, Memorandum to A.M.Gorman, 16 January, 1924, NAA: SP1063/1, 786. National Archives of Australia, Sydney. NAA SP1063/1, 786. All subsequent quotations of the Cilento-Gorman correspondence are from this source.
in a building’s interior. Where the kitchen was referred to, for example by W.J. Simpson, it was treated as a servant space, to be kept at a convenient distance from the principal members of the household. It was only in Australian publications, and particularly in Cilento’s reports, that the kitchen was considered significant, requiring considerable improvement for the sake of the health and welfare of settler women. To Cilento, the kitchen was the most important part of the house, and the place where most attention was required, particularly if the housewife spent most of her time there. His list of points about kitchen design closely matched the set of questions he developed for Nurse Gorman. Both emphasised cooling through the design and location of the stove recess and provision of ventilation, the lighting of the kitchen and designing for convenience. Cilento provided detailed advice about how to design a stove recess to best extract heat from the kitchen, how the sink ought to be placed in relation to the stove, and how to relate the kitchen to the dining room. Regarding the stove recess, he advised:

The stove should invariably be set in a recess which should be lighted by fixed lights on either side, and where possible, a shutter the full length of the recess opening outwards from the top, and protected by a 10 inch flushing should allow the air to be drawn through and reflect off the hot air rising from the top of the recess.

This recess was not merely a subsidiary space, but had been thought through to ensure that it was well lit, with windows, and relied on a system of vents to remove any heat build-up. Furthermore, Cilento recommended that it be screened to prevent any radiation of heat towards the sink. In his critique of the PWD’s proposals he also emphasised the need to

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83 Cilento, Report on Plans Submitted by the Undersecretary, Department of Public Works, Brisbane, January? 1924, Publications:"Housing Conditions of the North".NAA SP1061/1 128; Cilento, The White Man in the Tropics. 112.

84 Cilento, Report on Plans Submitted by the Undersecretary, Department of Public Works, Brisbane, January? 1924, Publications:"Housing Conditions of the North".NAA SP1061/1 128
maintain sufficient distance between the sink and the stove as otherwise conditions would be too hot for washing and preparing vegetables.

The questions posed by Cilento through Gorman were measured against an ideal, close to that of Balfour, inquiring not just into the presence of a particular feature, but whether it was proper or suitable to civilised living in the tropics. The sheer number and detail of the questions show the level of scrutiny that was expected but also Cilento’s firm notions about the organisation of an ideal kitchen. Cilento’s memorandum was exhaustive. He wanted to know whether the kitchen “was a room or a mere penthouse?”, whether the kitchen stove was “set in a properly constructed recess”; whether the kitchen had convenient access to water; was it “properly ventilated”; whether there were “suitable steps to the kitchen, not necessitating overstepping; whether the sink was “beneath the window or in a situation which allows of plenty of ventilation without actual draught?”. The questions also enunciated the preferred relationship between the kitchen and the rest of the house. Cilento wanted to know whether the kitchen’s location entailed “excessive walking or carrying” to get to other parts of the house and how it related to the outhouses. This was not just a question of proximity but also required recording any specialised wall openings, among them “a rubbish shoot [sic] through the wall to outside dustbin” and “servery hatches to the dining room”. The memorandum did not neglect vermin and insects, with questions about tank screening, sagging guttering, overflowing drainage and whether “mango trees are overshadowing the house, acting as mosquito harbourages?” Within the kitchen, he wanted to know not just whether there were any insects or that there were food and meat safes, but whether they were “raised from the floor and pushed out from the wall, so as to prevent the breeding of multitudinous cockroaches and other vermin”. In sum, other than the size, almost every aspect of the kitchen from its disposition to its utensils was to be recorded and judged against an ideal standard of hygiene, comfort and domestic efficiency.

Cilento had informed Gorman that the purpose of the Sociological Unit was “to inquire into conditions in which women in the inaccessible parts of Tropical Australia complain”. However in the developed survey form and in her reports, Gorman gave little information about the opinions of those with whom she met, only reporting on their characteristics and ‘domestic knowledge’. Her survey form developed Cilento’s questions into a checklist of features. It simplified the earlier set of questions but, in doing so, it only allowed a feature to be noted, not its construction quality. This contrasted with the other part
of the survey which attempted to grade the housewife’s understanding of domestic science and general household organisation on a scale from good to nil. Some of this was also perhaps due to the limited knowledge about construction details among the medical profession.

The information most valuable to the AITM and to the Department of Health was, however, not the conditions of women in the tropics or their housing, but their biological history over several generations. The previous chapter noted the pessimism amongst geographers, such as the American Ellsworth Huntington, and such medical experts as Leonard Hill and Andrew Balfour in England, regarding the possibility that white people could live and work in the tropics without risking degeneration in the long run. 85 Closer to home the Australian geographer, Thomas Griffith Taylor, held similar views and, from 1919, had regularly published articles in both the press and academic journals dismissing the practicality of settling northern Australia, drawing attention to the poor quality of much of the land and the trying conditions for many women and children. 86 Just which kind of woman could live in tropical Australia was also the subject of remarks by Ellsworth Huntington when he visited Australia to attend the Pan-Pacific Science Congress in Sydney in August 1923. Huntington chaired a session on tropical settlement, and argued that the apparent healthiness of tropical settlers was due to a combination of economic and natural selection. He singled out the women of Queensland as exemplifying this process, arguing that “the high standard of health among the women and girls of Queensland was due to the fact that the weak [his

85 See Ellsworth Huntington, "The Adaptability of the White Man to the Tropics in Australia," Geographical Review 10, no. 2 (1920):110-111. Huntington was highly critical of Breinl’s and Young’s use of statistics as they did not account for a population which he thought to be migratory, mostly male and picked. Hill was also pessimistic about the effects of the tropical climate on the fertility of white women, while Balfour revealed his agnosticism about white settlement in his paper on acclimatisation, much to the annoyance of Cilento, who had considered him an ally. Hill, "Notes on Tropical Climate and Health." Balfour, "Problems of Acclimatisation." Andrew Balfour, "Soujourners in the Tropics," The Lancet 201, no. 5209 (1923). R.W. Cilento, 22 October 1923.

emphasis] mothers and girls left the tropics”. Huntington’s remarks could hardly have gone unnoticed by Cilento and his colleagues at the AITM. Cilento also spoke at the congress. Huntington’s remarks about the selection of women and children for tropical residence were well publicised in the metropolitan dailies and, after the Congress, Huntington travelled to Townsville to meet Cilento and see third and fourth generation settlers for himself. However, as Warwick Anderson notes, this did little to change Huntington’s viewpoint.

Cilento urged Gorman to gather data about second or third generation settler children and any distinguishing aspects of their lives, such as whether there were any signs of physical weakness or degeneration at key developmental points in their lives such as in childhood, at puberty, before marriage and during pregnancy.

In 1924, beginning in Townsville, Gorman visited baby clinics, schools and people’s homes in northern Queensland. She surveyed 790 houses and 2068 children in seven towns, chosen for the climate they represented. The results were tabulated in a report published in the Commonwealth’s departmental publication *Health* in 1926 and also incorporated into Raphael Cilento’s celebrated publication *The White Man in the Tropics* in 1925. Gorman’s

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89 A.M.Gorman to A.H. Baldwin, 27 October, 1926, NAA: SP1063/1, 786, National Archives of Australia, Sydney. Townsville and Cairns represented the hot moist coastal climate; Atherton, Chillagoe and Charters Towers were in the coastal plateau country (then thought to be the most favourable and ‘temperate climate’), with Julia Creek and Cloncurry in the interior chosen as they had a hot-dry climate. See also: Raphael W. Cilento, "The White Man in the Tropics with Especial Reference to Australia and its Dependencies," Service Publication (Tropical Division) (Melbourne Commonwealth Department of Health, 1925), 75.

results indicated that few of the houses achieved the ideal conditions implied in the survey questions. For Cilento this supported an argument in favour of the sustainability of white settlement. He interpreted the report findings to suggest that, despite the conditions, there was no evidence that the tropics had any significant effect on the health and welfare of women and children. He emphasised the fact that, if anything, the random choice of houses included many of the lowest standard of dwellings (although he was careful to state that even the worst houses were not as bad as those found among European peasants or the poor of Alabama).91 For Cilento, the apparent fertility of women, and the normality of the age of puberty and menopause, all disproved the contention that women could only live for a short time in the tropics without their health being affected.92 Although the surveys showed that living conditions were far from ideal, Cilento drew satisfaction from the positive findings about what he saw as the greater issue—women’s health.

When the Australian Medical Congress declared northern Australia safe for settlement in 1920, it did so based on laboratory experiments and literature reviews. It had little in the way of field data and was dismissive of those whose experiences did not align with their support of tropical settlement. The ongoing debate about tropical settlement suggested that tropical homes might be in need of reform but the congress had little detailed knowledge of how tropical dwellers actually lived. The AITM’s survey of rural women (1924) covered a remarkably extensive set of women in tropical Queensland, extending the eyes of public health well into the country’s interior. This would not have been possible without the development of the QCWA. It also enabled the Institute to make the rural population of northern Queensland controllable by turning home environments into statistics and, through questionnaires, pamphlets and pre-prepared lectures based on an idealised norm, enable control at a distance.93 In this way the AITM fulfilled its federally mandated responsibility to scientifically secure white settlement in the tropics, through all means available—medical, architectural and civil.


C.D. Lynch’s one-room-deep, verandah-less house found an unusual outlet in the QCWA. One of its first objectives was to build a series of seaside huts to give country women a cheap holiday. The Association persuaded the government to grant it land as a health reserve at Kissing Point in Townsville. Lynch was appointed as the honorary architect and, with his associate, C.V. Rees, was tasked with drawing up plans. These were published in Brisbane’s *Daily Mail* in May 1924 (see fig. 3.6). As in Lynch’s earlier work for Breinl and Young, he completely dispensed with the verandah, a bold move for a building in the early 1920s. Instead, all sides of the building were fitted with pivoting windows and screens, approximating the ‘open air’ dining rooms of the quarantine residences on Thursday Island. Lynch and Rees worked hard to maximise the utility of the small interior—only 7.92m (26ft) by 7.32m (24 ft). They screened an area to the back of the hut for use as dressing rooms and a small galley kitchen. Collapsible beds enabled the living room to transform into a shared bedroom at night. The kitchen showed particular attention both to labour and space saving design: tables could flip down and an ironing board was hinged over the sink, while joinery accommodated kitchen cupboards and dressers, as well as wardrobes for each dressing room.
Figure 3.6. Ground Floor Plan of Each Home. Source: "Holiday Homes, Kissing Point, Townsville.,” Daily Mail, May 09 1924, 15

The hut’s economy was of great importance to the fledgling QCWA. Lynch’s and Rees’s design was cheap, with initial estimates at £330, a third of the cost of Lynch’s verandah-less house for Breinl and Young.94 This was helpful as the construction depended on the fundraising ability of the various branches of the QCWA. This aspect of the project for the coastal retreat helped to tie the various branches of the QCWA together, since inland branches raised funds to pay for an individual hut.95 Some, like Cloncurry, were up to 800km away from Townsville while others, like Dalrymple by Charters Towers, were much closer.


95 Queensland Country Women’s Association, Second Annual Meeting of the Council held in Council Chambers Brisbane November 17th, 1926 (Toowoomba: McDonald & Rosbrook printers, 1926), 14.
Between 1924 and 1926, branches in Dalrymple, Hughenden, Winton, Kynuna and Cloncurry all helped fund the huts. During this time the coastal branches, such as Townsville and Bowen, lobbied the government to obtain land, found a local architect to work for them, and looked after the maintenance of the buildings.96 The QCWA’s engagement with the project can be understood as relating to the value of the huts as devices for community building. Lynch’s work on them was influenced by earlier attempts on the part of social reformers to help rural women overcome social isolation as much as it represented a manifestation of his thoughts on tropical housing.

Figure 3.7. Site layout for QCWA holiday homes in Townsville Source: "Holiday Homes, Kissing Point, Townsville." Daily Mail, May 9, 1924, 15.

Lynch’s crescent-shaped layout for the Townsville scheme (fig. 3.7) is clearly indebted to Stowe’s plan for Narrabeen. Yet Lynch could adopt the model of a verandah-less one-roomed house without any press comment in 1924. In part this may be because attitudes were somewhat more relaxed for holidays than for dwellings. The huts were merely improved

versions of holiday tents (see fig. 3.8). Yet the design must have been well appreciated, as the
association continued to fundraise and build huts based on Lynch’s design up to 1937.97

Figure 3.8. The Queensland Country Women’s Association (Q.C.W.A.) huts at the
Strand, Kissing Point, 1932. Source: Cities Library Townsville, accessed

In the popular press, however, this counted for little. What mattered was the technical
servicing of the home. The most talked-about aspect of the huts when they first opened in
1924 was the kitchen.98 As well as the fold-down tables and ironing boards, the kitchen had
an enamelled sink, gas stove, gas lighting, dressers full of crockery, and a wide range of
kitchen utensils. While there was no stove recess, in all other regards the kitchen more than
met Cilento’s requirements for a labour saving workspace. Labour-saving devices, as David
Jeremiah has argued, were a means for the middle class in Britain to maintain their lifestyle


in the face of rising labour costs and post-war social change. In contrast, the holiday homes of the QCWA were a means for Australia’s rural class to take a break from their everyday lifestyle and access conveniences that were previously out of reach. By today’s standards the kitchen may seem small and rudimentary but the convenience of the huts and associated laundry was luxurious to holidaymakers who came from homes without even an ‘indoor water tap inside the dwelling’. In Kissing Point, holiday makers were still expected to cook, clean and wash for themselves, but labour saving devices considerably reduced the amount of time and effort this required, allowing members to devote more time to leisure, rest and play. The Governor-General and his wife, Lord and Lady Foster, opened the hut in September 1924, demonstrating the continued close links between the QCWA and the heads of state and continued attention by government to the question of white settlement and the advancement of Australian ‘civilisation’ in the tropical north.

In many ways Lynch’s design for the Kissing Point huts came closest to realising a cheap prototype for tropical living. It challenged the standards for segregating space and the expectation that the verandah was a necessity for building in the tropics. Yet although the huts proved popular, and their opening was widely reported, neither the architectural press nor the medical press paid any attention to them. Perhaps Cilento might have placed more significance on their planning, but by the time they were under construction, he had already left for New Guinea. Lynch largely drifted into retirement, his practice taken over by C.V. Rees, with a few notable buildings in the 1930s but none that drew as much popular attention as either his verandah-less house proposal or the Kissing Point huts.

The AITM Director’s House

Cilento managed to put his ideas about ideal house design into practice in one building, the Director’s residence for the AITM (fig 3.9), designed and constructed in 1924. Cilento never actually occupied the residence; by the time construction began he had left for Papua. However, the importance of the project for his thinking and his attachment to the design is


100 Pagliano, Country Women, 126.
evident in his later publications, which consistently reproduced the building’s plans and the
design ideas.\(^{101}\) Although Cilento described the house design and its details as exemplary,
related correspondence showed that it was far from perfect as a model for tropical settlers. Its
problems highlighted a number of blind spots in Cilento’s understanding of housing design.

Figure 3.9  Director’s Residence. *Source:* Cilento, *White Man in the Tropics*, 124.

The house formed part of a series of building works carried out at the AITM complex in
Townsville in 1924 and 1925. The physical expansion of the Institute reflected the
expectation that it would become “the centre of Medical Science for the whole of northern
Australia”.\(^{102}\) Full plans for the house were produced in May 1924 by Harold W. Barker, who

\(^{101}\) In particular see ‘The White Man in the Tropics’ and JVD Coutts’s 1934 publication ‘Western Housing and
Cilento, "The White Man in the Tropics with Especial Reference to Australia and its Dependencies."

\(^{102}\) R.W. Cilento to The Secretary, Townsville Hospital Committee, March 16, 1923, NAA: SP1061/1, 10,
National Archives of Australia, Sydney.
was then a works inspector at the Department of Works and Railways, Brisbane.103 Two months later, the Townsville *Daily Bulletin* published a call for tenders for the construction of a new director’s residence and infective laboratory at the AITM.104 The house was pegged out by October and completed sometime before July 1925.105 Although Cilento was no longer in Townsville when the plans were produced and the building went to site106, its layout bears all of the hallmarks of his attitude to tropical housing.

The plan was organised so that the main accommodation was placed to the front, with a service wing and further bedroom wing arranged in parallel behind. These two wings to the rear shifted so that each room could be cross ventilated. A large 3.05m (10 ft) deep verandah wrapped around the front, expanding to 5.49 (18 ft) in front of the dining room to form an outdoor lounge. To the rear another 3.66m (12 ft) deep verandah occupied the space between the bedroom wing and service wing. This gave the impression that the house was only one room deep.

The AITM director’s house offers an excellent demonstration of the transnational flow of ideas about housing through the networks and publications of tropical architecture and their modification to local circumstances. Although the arrangement of the house was unlike that of any other tropical house in Australia, it does bear similarities to a plan published by Balfour (fig. 3.10) for a European Bungalow in Khartoum. Designed by the engineer W.H. McLean before 1908, the plan similarly places service rooms in the rear

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103 H.W. Barker, Townsville Tropical Institute - Director's Quarters, 30 May, 1924, NAA J2774, W1316, National Archives of Australia, Brisbane.


105 J.S.C. Elkington, Memorandum: Director's Residence, Australian Institute of Tropical Medicine, Townsville to Director-General of Health, Melbourne, 21 July, 1925, NAA: A1928, 832/3 SECTION 1, National Archives of Australia, Canberra; A.H. Baldwin to Director, Division of Tropical Hygiene, Brisbane, 6 October, 1924, NAA: SP1061/1 20, National Archives of Australia, Sydney.

106 Cilento was initially sent on secondment for a year as the Director of Public Health for the territory of New Guinea, leaving Townsville in late February/early March 1924. "Dr. Cilento: New Guinea Appointment," *The Brisbane Courier*, 9 February 1924, 16. However this was extended by the Commonwealth for a further three years in 1925. "Fighting Disease in New Guinea: Dr R H Cilento's Travels," *Recorder*, 2 April 1925, 1.
corners, offsetting them in such a way that the main accommodation can be ventilated from the front and rear. McLean’s plan also contains a rear verandah between the service wings and the main accommodation and a wrap-around verandah at the front and sides. Unlike the AITM director’s house, however, McLean’s plan staggers the bedrooms and dining room to create a centrally located porch, which also allowed cross ventilation of the main rooms from the side. By contrast, the front verandah of the Director’s residence expands towards the street to form a lounge with connection to the street via a parallel set of stairs.

Figure 3.10. McLean’s Plan for a European Residence. Source: Balfour, Third Report of the Wellcome Tropical Research Laboratories, 70.

Cilento would have been well aware of McLean’s design. It was republished by Balfour in 1921, in his chapter on ‘Habitations and their Annexes’, which was Cilento’s main point of
reference for tropical housing design. When Cilento wrote about tropical housing he closely followed Balfour’s work, going so far as to include another one of McLean’s drawings (which Cilento credited to Balfour) in ‘White Man in the Tropics’. Although the Sudanese house design clearly informed the planning of the Director’s house in Townsville, however, its translation was mediated by Queensland’s material traditions and climate and, importantly for this discussion, Cilento’s concerns about domestic efficiency and kitchen design.

The Director’s house did represent a simple, direct copy of a design from elsewhere, but one modified from a restricted if relevant range of precedents by Cilento’s own ideas about housing and the building traditions then prevalent in northern Queensland. While the staggered plan of the house was close to that of McLean’s Sudanese house, the functional relationships between the various rooms, their planning and the features of the house more closely matched Cilento’s previous writing about tropical housing. As mentioned, the verandahs were deep and the internal ceilings were high at 3.94m (10ft 11in). The bathroom at the rear of the house was within easy reach of the main bedrooms and people were not required to pass through the dining room to get there. All bedrooms had built-in wardrobes, a relative novelty at this time. The open verandah also contained a linen press, while the kitchen and dining room were connected by a servery hatch with a dresser underneath. The kitchen was large at 4.88m (16ft) by 3.66m (12ft); a stove recess, lit from both sides, was placed well away from the sink on the other side of the room. Each room had a ceiling vent; initial drawings show that a roof ventilator was considered but omitted at a later date. The


108 For the original drawing see: W.H. McLean, "Dwelling Houses in the Tropics (with special reference to the Sudan)," in Third Report of the Wellcome Tropical Research Laboratories at the Gordon Memorial College, Khartoum, ed. Andrew Balfour (Khartoum: Dept. of Education, Sudan Govt.; London: Baillière, Tindall & Cox: Wellcome Tropical Research Laboratories, 1908), 71. It was then republished uncredited in Balfour, "Habitations and their Annexes," 44. As it was published again by Cilento and credited to Balfour, this would suggest that Cilento had access to Byam and Archibald’s ‘Practice of Medicine in the Tropics’ but not to the Wellcome Institute’s Third Report where McLean first suggested the plan. For an overview of McLean’s planning of Khartoum and his housing design see: Robert Home, "British Colonial Town Planning in the Middle East: The Work of W.H. Mclean " Planning History 12, no. 1 (1990): 4-9.
eaves were carefully designed with a 305mm ventilating space to ensure any hot air built up under the verandah could enter the ceiling space and be exhausted through the roof. All side windows were covered by hoods. Water was collected from the roof in a 100-gallon tank, located close to the kitchen. In addition, a new sewer pipe removed waste from the bathroom, kitchen, laundry and earth closet.

While doctors like Cilento advocated servant-less living, they themselves were not willing to trial its virtues. Like the quarantine buildings described above, the director’s house was designed to accommodate a maid. Whereas the kitchen appeared to be well laid out, the maid’s room was hidden to the side, with a separate lobby entrance. Two variations on Cilento’s house reappeared in 1934 in a publication on Western Housing and Tropic Design, where it was considered a suitable residence for a station manager in the far west or far north of Queensland. Cilento advised on the publication, whose chapter on ‘Tropic Design’ bore a close similarity to his 1920s writing on housing in the tropics. The book claimed that ‘coloured labour’ was obtainable in the Far North and this permitted “a more “rambling” layout that helped to improve cross ventilation”. 109 It would appear that the servery hatch was not as appealing in the mid-30s. With servants, the book claimed, kitchens could be located further away from the dining room, simultaneously reducing odours and making the cook’s bedroom more accessible. 110 While Cilento was actively promoting the value of Queensland servant-less living in the early 1920s, before too long class had apparently trumped egalitarianism in his own attitudes.

Although the house had many innovative features, both in terms of its planning and construction, its environmental performance does not appear to have been as good as Cilento claimed. The house was positioned to align with Gregory Street, which Elkington acknowledged was not ideal. 111 The long axis of the building was north-east to south-west so that the main rooms of the building faced north-west. Although Cilento acknowledged that adjustable shades were increasingly prevalent in Queensland, they were not specified for the

109 Coutts, Western Housing and Tropic Design, 34.
110 Coutts, Western Housing and Tropic Design, 34.
Director’s house in Townsville. On vacating the residence in 1929, the long-suffering Acting Director of the Institute, A.H. Baldwin, vented his frustration to Cilento about the front verandah: “It receives the whole glare of the afternoon’s sun and that light reflected from the road surface. The glare was found so intolerable that the Acting Director installed at his own expense ten (10) Aerolax blinds at a cost of some £2/5/- each.” Nor did Cilento notice that he had misinterpreted advice for orienting buildings. In his report to the PWD in 1924, and in The White Man in the Tropics the following year, he recommended that buildings should be set out along an axis “east-north-east to west-south-west for southern equatorial regions”. Although this advice for orienting buildings was published by Balfour, it came from Cameron Blair, a doctor in Nigeria, who acknowledged it to be the ideal orientation for buildings lying “between the Equator and the Northern Tropic”. Surprisingly, for someone so concerned with the tropics, Cilento in this case failed to distinguish between regions north and south of the equator.

The house was never directly replicated and had no discernible influence. Its cost was problematic, both for the department and for those expected to reside there. It had been designed for a well-paid Director, married with children, but was eventually used as a share-house for the Institute’s lesser-paid bachelor officers. When the house was completed in July 1925, A.H. Baldwin initially refused to live there. At this time, if an officer occupied four rooms or more in a house they were charged 10% of their income in rent. For one to three rooms, however, they were only charged £3 per room. Baldwin later noted the absurdity of the arrangement: “three rooms can be rented for £12 but if I take an extra room it would cost me over £100”. This left the Department of Health with a set of problems. They did not


113 A.B. Baldwin to Director-General July 30, 1925, NAA: A1928 832/3, National Archives of Australia, Canberra.

114 A.B. Baldwin, Memorandum Re: Rental Deduction and Marriage Allowance, May 20, 1927, NAA: A1928 832/3, National Archives of Australia, Canberra.
want the building lying idle, at risk of vandalism and without any rental income.\footnote{Elkington, Memorandum: Director's Residence, Australian Institute of Tropical Medicine, Townsville to Director-General of Health, Melbourne, 21 July, 1925.} He recommended the house be shared between a technical assistant at the AITM, Mr. Fielding, and two other officers. Fielding was to get the maid’s room, kitchen and bedroom, while the two others would each get a bedroom and share the dining room and lounge. This arrangement only generated £24 rental income per annum while the house had cost the Department of Health £2,379.\footnote{A.B. Baldwin, Note to Director General, July 30, 1925, NAA: A1928 832/3, National Archives of Australia, Canberra.} While this worked to keep the house occupied, and the bachelor officers at the Institute saved money on their rent, the amount did not even cover the maintenance costs.

The house limped on, its setting much compromised by the later annexe to Townsville hospital designed in 1944. Although the Institute’s original building made it onto the federal heritage register in the early 1980s, the Director’s residence was disposed of during this decade.\footnote{For documentation on attempts by the Department of Health to dispose of the buildings that once comprised the AITM in Townsville see Townsville - Commonwealth Health Laboratory for Institute of Tropical Medicine (Health) including Director's quarters, 1961 - 1989, NAA: J56, QL604 PART 2, National Archives of Australia, Brisbane.} Perhaps the irony of the building’s occupation is that it was most attractive as a temporary house for unmarried migrant scientists and never conformed to Cilento’s vision of fertile settledness.

From Town Planning to Architecture

Contemporaneously with his efforts to activate the AITM and QCWA, Governor Nathan pushed the Queensland Town Planning Association (QTPA) to consider tropical housing. He did so just as controversy raged in the press and parliament over the conditions of workers’ houses in northern Australia, which Sir George Buchanan had described that May as nothing...
more than ‘tin boxes’.118 Yet again a technical expert with authority, this time a British civil engineer, was criticising the thermal conditions of housing. Yet again this expert implied that colonisation efforts would fail due to women’s discomfort. And once more Nathan searched for an outlet to push his agenda for better tropical housing. His efforts, however, met with only limited success.

Buchanan, a British civil engineer specialising in harbour design, had been brought to Australia by the Commonwealth government to advise on the development of the ports and docks throughout the country. Yet it was his damning comments on living conditions in northern Australia, and the effect of poor housing on the efficiency of White labour, which riled public health officials, like J.S.C. Elkington and Sir James Barrett, who engaged in a press campaign to discredit Buchanan’s criticism and defend the suitability of tropical Australia for white settlement.119 Although they agreed that housing conditions were poor, they argued that this did not mean that white labour was inefficient or ought to be replaced by coloured labour, as Buchanan had suggested. Nathan also responded, requesting that the association look into “the standardisation of dwellings suitable for tropical and sub-tropical parts of Queensland”. Drawing on English experience, he saw potential in prefabricated steel and new materials like celotex to reduce costs. He also suggested building a model house for the Royal National Exhibition and training people in constructing houses of a “standardised pattern”.120 Not everyone on the executive of the QTPA agreed with the Governor. Alderman Thomas Prentice noted that the problem had already been considered at length at the Town Planning Conference in 1918 and that, in any case, the executive would have no problem.


“designing a plan suitable for Queensland conditions”. J.V.D. Coutts, the busy-body editor of the *Architectural and Building Journal of Queensland (ABJQ)*, thought it was mostly a question of materials, with future designs dependent on the progress of the Celotex and fibro-cement industries in Australia. The executive, however, agreed to look into the matter and sought the help of the architect members of the association.

In effect, Nathan was asking the QTPA to reconsider the problem of the tropical house while at the same time transferring responsibility for it away from medical bodies such as the PHA or the AITM to the QTPA and, from there, to architects. He was attempting to get the Association to revisit an issue that they thought had been settled at their conference in 1918, as once more tropical housing and its construction was emerging as a political issue. Of all the people concerned with the tropical house, it was Nathan who delegated responsibility to agencies and was most influential in reorganising and connecting the networks of participants. Yet, although he influenced the composition of the network in terms of which social bodies were included, his constant reshuffling undermined the durability of any one agency’s ties to the problem of the tropical house. Let us recall that when Brydon suggested a competition, in September 1922, to women at the BHC, Nathan took her idea to another agency, the PHA, one month later and asked them to run it. With his initial proposal, he cut off the participation of the BWC. In his attempt to increase the competition’s importance by offering large prizes, he raised the cost of organising it, effectively killing the competition and the participation of the PHA. He then paired up the AITM and the PWD in 1923 in a short-lived alliance, whose main outcome seems to have been limited to a book chapter by Raphael Cilento, which did not appear until late 1925. Finally in June 1925, with the arrival of a visiting engineer and renewed controversy over the tropical house, he turned to the QTPA. Now it was their turn to come up with an ideal tropical house, only this time the problem would shift from the wet coastal tropics to the arid interior of Western Queensland.

Nathan finished his term as Governor in September 1925 and there was little discussion of tropical housing by the QTPA until their sixth annual meeting in August 1928,


122 Cilento, The White Man in the Tropics with Especial Reference to Australia and its Dependencies.
when J.V.D. Coutts lamented that his sub-committee had done nothing to advance housing standards in Western and North-Western Queensland and recommended that the incoming committee look into it.\textsuperscript{123} With Nathan gone, there were no longer any formal connections between the Country Women’s Association, the PHA and the QTPA. It was not as if the issue went away: at the annual Country Women’s Association conference in October 1927, delegates called for improvements in housing conditions and water supply in Western Queensland to prevent “the drift to the cities, where by contrast conditions appear almost as Fairyland”\textsuperscript{124} The focus for country women shifted from Queensland’s humid tropical coast to its sparsely populated arid interior. Coutts’s renewed interest in western housing conditions came shortly after he completed the Hotel Richards in Mitchell, Western Queensland, which he published in February 1928, emphasising its widespread use of Celotex and fibro-cement sheeting.\textsuperscript{125} After a three year lull, Coutts went on to spearhead the QTPA’s campaign to improve housing in Western Queensland, giving lectures and, in due course, organising a housing competition.

When the QTPA started to look at housing for arid, western Queensland it adopted a paternalistic approach, certain of its ability to direct settlers in how to build. It claimed that its work was to offer guidance to “settlers in the ‘way back country” and believed that housewives suffered poor health and discomfort due to lack of available information.\textsuperscript{126} It was here that the Association believed it could play a role, since it could offer “the advantage of experience that it is capable of securing in the direction of defining what is essential towards the well-being of the settler so far as domesticity is concerned” and could do this without increasing the cost of construction.\textsuperscript{127} Confident of their expertise and experience, the Brisbane members of the QTPA were certain that the problems of settlers were due to ignorance rather than poverty and claimed the right to direct them in how to live.

\textsuperscript{123} “Town Planning Association,” \textit{ABJQ} 7, no. 75 (September 1928): 59-60.

\textsuperscript{124} “Country Women - Charleville Conference - Growth of Western District,” \textit{The Brisbane Courier}, October 5, 1927.

\textsuperscript{125} “New Modern Western Hotel,” \textit{ABJQ} 6, no. 68 (February 1928): 30,34.

\textsuperscript{126} “The Housing Problem - Town Planners’ Interest,” \textit{ABJQ} 7, no. 75 (September 1928): 16.

\textsuperscript{127} “The Housing Problem,” 16.
Architects also claimed the privilege of expertise to protect the nation’s interest. The QIA, in its campaign for registration, claimed that the expertise of architects would protect the public from ‘jerry-builders’. In 1928, Queensland passed laws directed at regulating the title of architect. With registration also came the expectation that architects had a duty to the state to “evolve designs for every part of Queensland”. Coutts pressed forward with his research on western housing conditions, presenting a paper to the Association in June 1929. He reduced the problem of the house to one of ventilation and cost, paying particular attention to material supply and transportation costs; he said little about aesthetic criteria but advocated new materials (like asbestos sheeting).

Coutts’s paper paved the way for a new competition on the tropical house and gave momentum to the QTPA’s interest in housing in the outback, which was increasingly understood by architects as a problem they should address. In October 1929 the QTPA decided to ask the QIA to stage a design competition for “dwelling [sic] and material that are suitable for western conditions”. More than six years after M.H. Brydon first mooted the idea, a competition was on the cards.

The Competition for Western Homes

This time the QIA proposed two separate competitions: an essay competition, which closed at the end of January 1930, and a design competition the following June. Just as Brydon had once proposed, the competitions were open to all entrants and did not seek detailed technical proposals but “briefly practical and economic suggestions”. The prize fund was also significantly reduced, with a total of just under £20 for the two competitions. Rather than

130 J.V.D. Coutts, ”A Western Housing Scheme,” ABJQ 8, no. 85 (July 1929): 21-23.
131 Coutts, “A Western Housing Scheme;” 21.
133 “Competition: Western Housing Scheme,” ABJQ 8, no. 89 (November 1929): 44.
provide competitors with information from foreign experts, as Nathan had originally wanted, the QIA sought to translate local experience of western conditions into useful essays for the design competition. Fifteen people entered the essay competition, including many non-architects. Significantly, the winning essay, by a Miss Lumsden of Toowoomba, dealt not with problems of ventilation and economy as Coutts had done, but with the issues of dust, flies, ants and impure water. Coutts himself was awarded second place, a dubious honour, given his role in organising the competition and the lack of information on the judging panel.

The winning essays were published widely in the Queensland press and the ABJQ in February 1930. The organisers hoped that they would be used by entrants to the design competition, but very few of the 36 entrants to the latter paid any attention to them. In fact, the judges J.C. Cavanagh, J.V.D. Coutts and R.M. Wilson expressed their disappointment in the quality of the schemes, most of which were deemed to be “more suitable for Suburbia than Western Queensland”. Outside of the architectural press, only the Brisbane Courier published the winning schemes.

Figure 3.11. Winning Scheme for £600 Western Home. Source: Coutts, Western Housing, 23.


135 Coutts, Western Housing and Tropic Design, 11.
Far from showing a distinctive design approach for Western Queensland, the profession treated it as another kind of suburbia. In many ways the competition was a complete failure. *The Brisbane Courier* noted that, despite the large number of entries, the designs were unremarkable.\(^{136}\) The winning scheme (fig. 3.11) was essentially a modified version of the ‘Monthly home’ published in the *A & B Journal* in March 1930, with few concessions to the conditions described in any of the essays. No great innovative design was found, no new star was born and the QIA subsequently received little publicity about the scheme.

![Diagram of a house](image)

Figure 3.12. Coutts's Ideal Solution for a Western Home. Source: Coutts, *Western Housing*, 29.

\(^{136}\) “Western Houses,” *Brisbane Courier*, June 24 1930, 10.
If the first competition was scuppered by funding problems, the second one failed due to professional hubris. In an ironic twist of fate, it was the architectural profession which required instruction, not the settlers in the outback. Coutts took it on himself to educate the architectural profession, publishing his own attempt at a suitable design in August 1930. The two-storey, tri-partite plan provided deep verandahs to the front and rear, which were either glazed in or gauzed to protect occupants from dust and flies. Coutts explained the benefits of his plan in terms of its flexibility, compactness and potential for cross-ventilation, and claimed that further savings were possible by altering the ground floor construction. Despite this, when he finally (in 1934) collated his essays, his own design (fig. 3.12) and a number of the winning designs into a book on *Western Housing and Tropic Design*, he still claimed that no perfect house had yet been designed for the tropics. He noted that “it may be that many of our architects have not given very careful thought to the design of suitable homes”. A suitable home, to Coutts, was one which considered the provision of coolness, economised on housework and took account of the cost and suitability of materials used for construction. Despite the passage of time, there was little difference between Coutts’s and Brydon’s expectations of a suitable house for western Queensland.

**Conclusion**

When the Australian medical profession decided to turn its attention to the conditions of tropical settler life, it brought within its remit a new subject, the tropical housewife. In doing so, it made physiological research on workplace conditions appear prescient. The problems of tropical settlement served to domesticate the debates about industrial working conditions by recasting the house as a workplace, not a place of rest. Doctors attempted to use their own institutions to trial new forms of housing, with only limited success. At the same

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140 Coutts, *Western Housing and Tropic Design*, 16.
time, efforts to promote relief from the thermal conditions many rural families faced were brought to the fore, less due to the political imperatives of tropical colonisation than to the political organisation of women’s groups. Women’s associations managed to implement their ideas and have more impact than medical proposals for tropical housing, as they created something that was seen as desirable by the community and which made a prestigious good like holidays possible for even the poorest families. They avoided any attempts to change the way people lived at home, concentrating on a change of scene rather than better housing to provide relief. Yet the seaside homes also played a cultural role, introducing countless families to the merits of labour-saving devices, hot water and open plan living. The thermal relief they provided was of far less importance than the social relief on offer.

While little appeared to have changed in thinking or expectations about what a suitable house for the tropics might be, the discourse on housing had shifted from the medical to the architectural profession. Both Nathan and Coutts played key roles in catalysing discussion and translating the problem of housing in the tropics from a public health to an architectural issue. Nathan provided initial momentum to many schemes. As his support was only partial and temporary, however, he undermined each agency’s attempt to produce an ideal tropical house. When the Governor left, Coutts took up his call for better housing and attempted to educate Brisbane planners and architects about housing in the interior. Competitions played a role in generating publicity about the issue within the community. At the same time, the process of organising a competition and the lack of traction that followed also brought a range of disparate bodies into each other’s sphere of influence. The expected panorama of design expertise, both local and foreign, that the competition was supposed to foster did not transpire at this time. Those directing the profession misjudged the ability of architects to understand and improve the material conditions of life in remote locations. Indeed, soon after the competition, the profession lobbied the State government to create an architecture chair at the University of Queensland so that precisely these issues would be addressed through professional training. This is discussed in the next chapter.

The intense medical scrutiny of tropical housing was short-lived, but it served to frame the house in physiological terms and to bring medical, women’s and architectural organisations together around a common cause. In time, women’s groups held less sway, replaced by the involvement of government bureaucracy. Indeed, as the following chapter explains, tropical housing shifted from being a form of civic action, of democratic
participation, into an instrument of bureaucratic government. The tentative fora formed by concerned citizens became the basis for interdisciplinary working groups as tropical architecture slowly became institutionalised and remade into a form of social security in which the architectural profession made an explicit claim.
Chapter 4 Post-War Reconstruction and Technocracy

The previous chapter described how the domestic environment of white tropical settlers in Queensland provoked considerable anxiety among the medical community and concerned citizens. Other than offering temporary relief through cheap holidays, however, attempts to ameliorate conditions during the inter-war years produced few lasting results, as most proposals were either beyond the means of those for whom they were designed or could not generate sufficient community interest to proceed. In 1942, tropical housing first became the subject of government inquiry in Australia, initially through the State government of Queensland and then throughout the Commonwealth. Where previous investigations had been sporadic exercises, motivated by the personal interest of select public officials and pressure from women’s groups, for the first time tropical housing became the focus of systematic study.

This development was part of a broader government vision of housing as a form of social security that emerged in metropolitan centres in the aftermath of the Great Depression and gained momentum during the Second World War, which many saw as evidence of the failure of earlier reconstruction efforts. As the historian Stuart Macintyre notes, “the previous war was so vivid in the public memory, its toll so heavy and the divisions it opened so deep, that the commencement of a new war brought an immediate resolve to break decisively with the past and lay down fresh foundations.”1 Professional groups sought to capitalise on the space opened up by reconstruction efforts and to advance their agenda for the creation of a new order. The reform of the tropical house was no longer seen as simply a medical issue or a women’s problem, as it had been during the 1920s. In the face of wartime shortages, it became an economic and material problem that required its own research apparatus and technical expertise. In the process, the tropical house—as a site of social and technical experimentation—shifted from the domain of medicine into that of architecture.

1 Stuart Macintyre, Australia’s Boldest Experiment: War and Reconstruction in the 1940s (Sydney: New South Publishing, 2015), 52.
This chapter focuses on the ways in which the Second World War created the conditions for the institutionalisation of tropical architecture, with the house as its focus, and how these new institutional structures facilitated the transformation of medical perspectives on tropical housing into architectural ones. During the war, both State and Commonwealth governments funded research into the tropical house, producing their own sets of model designs and, in the case of the Commonwealth government, setting up a dedicated research program into the problems associated with climate and small house design. This brought architects and medical experts together, either in an interdisciplinary committee, in the case of Queensland, or as research partners in the case of the Commonwealth Housing Commission (CHC). These collaborations produced a set of publications that informed architects and house builders alike about the rational design of buildings that were thermally comfortable to inhabit and economic to construct. Yet, as I later suggest, tropical architecture was only partially institutionalised in Australia after the war; there was no dedicated journal or course with a specific focus on tropical architecture until the early 1960s. Instead, the concerns and methods of tropical architecture and tropical physiology were subsumed under the umbrella term of ‘climatic design’, as the climatic performance of buildings was detropicalised and applied to the whole of Australia.

At the same time, the myriad new construction methods and materials that emerged during the war created both excitement and apprehension among architects, government agencies and the general public. Could they collectively guarantee the expected improvement in living standards after years of austerity? Thermal performance became the benchmark against which the efficiency of foreign and traditional methods and materials could be assessed. As a consequence, houses across Australia began to be regulated as physiological objects, and the test of a building’s modernity lay not just in its appearance but in how well it could control overheating.

The chapter starts by examining the revival of medical and political interest in tropical settlement just before the start of the Second World War. It considers, too, how the war created a housing crisis with implications for housing in the tropics. It then describes the first moves to institutionalise tropical architecture with the formation of the Queensland Tropical Housing Committee (QTHC) in 1942 and examines the committee as a mechanism for the exchange of medical and architectural knowledge on tropical housing, exploring the inevitable tensions between committee members with disparate professional or disciplinary
backgrounds. It then turns to the CHC to understand how tropical housing was regarded, in the context of post-war reconstruction, as both a special case and a general approach to housing design, one with application across Australia. It does this by analysing the discussion of solar planning tools in the CHC’s final report and the development of a climatic research program at the newly formed Commonwealth Experimental Building Station (CEBS). The chapter concludes with a discussion of the legacy of the publications on climate and architecture that came out of the QTHC and the CEBS, arguing that these formed the basis for both the Australian architectural profession’s post-war understanding of climate and internationally informed discussions on housing design in hot climates.

Reviving Northern Settlement

Japanese expansion throughout the Pacific in the late 1930s brought renewed attention to the question of how to increase the population of northern Australia. The inter-war period saw the formation of a general consensus that populating the north was imperative to secure Australia and protect its sparsely inhabited lands from an Asian influx. Dormant controversies about tropical acclimatisation were revived, with emphasis placed on the need for nationally coordinated and funded medical research. Architects had little involvement in this controversy, much of which centred on the issue of how to translate research on industrial fatigue in Europe and America into a tropical context.

In July 1936, at a meeting of the Rotary Club in Brisbane, former Prime Minister Billy Hughes expressed his concern that war in Europe seemed imminent and that neither Britain nor the League of Nations could protect Australia in the event of it spreading to the East. Australia’s borders were far more exposed than they had been in the Great War. For Hughes, weak international protection combined with population pressures elsewhere meant that it was necessary to build up the country’s defence capability: “None invites, by its circumstances, the crowded masses of the old world more than we do. We must do something to justify our occupation of this country, and as prudent men, must make preparations which

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are becoming of us.”³ During the inter-war years, as Russell McGregor notes, Australia, with its vast “empty spaces”, stood accused of adopting “a dog in the manger” approach to territorial occupation.⁴ Instead of providing an outlet for population pressures in Europe and the East, it restricted immigration and appeared to place little value on what, elsewhere, was a precious commodity—land.

Two months after the Rotary Club meeting, D.H.K. Lee (introduced in Chapter 2) gave his inaugural address as founding Professor of Physiology at the University of Queensland (UQ). In it, he repeated the “dog in the manger” argument, echoing Hughes’s fears that the country risked invasion. Where Hughes advocated defence by military expenditure, Lee advocated defence through tropical settlement. “Rightly or wrongly”, Lee contended, “our seclusion of large areas of unoccupied territory do call forth comment abroad. To meet these implied criticisms we must demonstrate either that we are in the process of settling these areas or that, after a thorough examination of the problem, we have concluded that they are uninhabitable upon an economic scale”⁵. Both Hughes and Lee acknowledged the tenuous hold of the settler society on the continent, that not all of this land was the home of European Australians. All the while, the international community was witnessing the rise of an apparent threat.

Lee was central to medical efforts to systematise the study of the tropical acclimatisation of Europeans. Appointed to UQ in 1936, he would for the next eight years promote his own research on “the effects of heat on the European” to politicians, academics and civil servants, arguing that it could answer questions about the extent and methods of possible tropical settlement. His work, as we shall see, provided a coda to settlement schemes based on medical topography such as those of Osborne and Barrett, discussed in Chapter 2. More importantly for the discussion that follows, Lee’s willingness to extend the metrics of tropical physiology into the technologies of everyday life paved the way for their adoption by tropical architecture.


Lee helped to place recent developments in the field of physiology and industrial hygiene at the service of northern expansion. In his inaugural lecture (1936), he pointed out that, compared to the early 1920s, when doctors last addressed questions of tropical settlement, there were now much more precise methods of measuring the combined effects of heat elements on the body. The kata thermometer and effective temperature scale could account for a combination of air temperature, humidity, wind velocity and, in some cases, radiant heat. In addition, medical researchers better understood how these affected the regulation of the body’s systems. Lee argued that this would allow better informed guidelines for populating the north to be developed. Unlike Griffith Taylor, he did not try to advise on how land could best be exploited economically, but he did claim that previous schemes had failed when economic interests were placed before physiological needs. In other words, physiology rather than economics was the ultimate test of the possibility of settlement.

In 1940, with the European War underway but with more than a year to go before the start of the Pacific War, Lee developed a framework for assessing the physiological stress of tropical settlement. The framework assessed the susceptibility of particular people, environments and technologies to thermal stress. To do this, he adapted the American Society of Heating and Ventilating Engineers’ (ASH&VE) “comfort zone” as the baseline against which to measure thermal suitability. Although the comfort zone was developed to assist engineers and air conditioning operators understand the ideal set-points for their systems, in Lee’s hands it became a tool for white settlement. Like Osborne before him, Lee transformed an index for industry into an index for settler colonialism. Also like Osborne, he believed that European settlement needed to be informed by physiological indices, with isothermal lines determining where and how people could establish towns and farms. Unlike Osborne, however, he saw comfort, rather than the limits of thermal tolerance, as the barometer of settlement.

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7 For a history of development of comfort indices and the professional battles they entailed, see Gail Cooper, Air-Conditioning America: Engineers and the Controlled Environment, 1900-1960 (Baltimore, Md.: John Hopkins University Press, 1998), 51-79.
In the process of this adaptation, maps (such as that in figure 4.1) changed from simply defining thermal ‘no-go’ areas to spatialising the level of thermal adaptation required. Osborne had simply wanted to find out whether parts of Australia were out of bounds for European settlement. Lee, instead, defined not only which parts of the continent were out of bounds but also the scope of necessary intervention for the remaining areas. A lower norm, the comfort zone, was the threshold for intervention. Lee defined it as “a range of effective temperatures over which people, on average, feel comfortable,” which he later amended to “conditions in which 50 per cent of people feel comfortable.”8 Thus the term glossed over the fact that just as many people would not be comfortable with the temperature as would be. The upper norm was taken to be 30°C (86°F) Effective Temperature, the point at which “men lightly clad and sitting at ease showed a breakdown of homeothermy” (a stable internal temperature).9 By introducing a lower as well as an upper norm, Lee could categorise climatic differences in Queensland based on how and when intervention was necessary.

8 Douglas H.K. Lee, "A Basis for the Study of Man's Reaction to Tropical Climates," Papers of the Department of Physiology, University of Queensland 1, no. 5 (1940), 65,74.

9 Douglas H.K. Lee, "Assessment of Tropical Climates in Relation to Human Habitation," Transactions of the Royal Society of Tropical Medicine and Hygiene 33, no. 6 (1940), 604.
Lee broke Queensland’s climate down into the “subtropics”, “marginal tropics” and “tropics” based on a location’s 9am and 3pm average daily temperatures. The classification system closely resembled the political division of Queensland into Southern, Central and Northern regions. Lee took Brisbane’s subtropical climate as the norm for Queensland, against which the rest of the state’s climates were then measured. The subtropics were considered safe and harmless for Europeans. In contrast, the “marginal tropics” and “tropics” were locations requiring climatic technologies, and even settler selection.\(^\text{10}\) Thermal suitability became the test for determining the level of climatic deviance of existing towns and which kinds of Europeans could settle in particular parts of northern Australia (see fig. 4.2). Even though

\(^{10}\) Lee, "Assessment of Tropical Climates,” 613.
doctors held that technical adaptations made life more tolerable in the tropics, in 1940, physiologists still believed that one’s genetic makeup played a role.

Figure 4.2. Climatic Comparison of Towns on the Basis of Comfort. Source: Lee. "Assessment of Tropical Climates," 611.

The military’s engagement in the tropics during the Second World War would give Lee the means to further study the (European) body’s reaction to hot environments and a range of applications for his methods of assessing thermal stress. In the 1920s, public health officials like Cumpston dismissed the psychological strain of living in the tropics as mere “kitchen neurasthenia”. Yet by the 1940s, military doctors began to pay more attention to the relative lack of concern about the psychological, as opposed to physical, challenges of tropical environments. Lee was not satisfied with simply understanding how the body adapted to
climate or classifying the types of climate in Queensland according to the level of thermal
stress to which they would subject the body. He also wanted to see that technology was
rationalised to make it easier for the body to maintain homeothermy. Clothing, house
construction, air-conditioning and personal habits were all viewed as technologies to
moderate the environment, creating what William Cronon terms a “second nature” that
minimised external stress on the body. As we shall see shortly, this physiological
rationalism was extended to architecture when Lee joined the Queensland Tropical Housing
Committee in 1942.

How the War Created a Housing Crisis

Improved housing was a prominent feature of the Federal Government’s early scheme for
post-war reconstruction, which dates to February 1941. Few, though, could have imagined
the material and labour shortages Australia would face over the next four years. Following
the bombing of Darwin on February 19, 1942, Australia entered into a state of emergency.
The government commandeered labour and materials as it greatly expanded industrial
production to help defend the nation. By June 1942, 145,000 women were working in war
industries, a tenfold increase since December 1941. A further 45,000 were in the armed
forces. By August 1942, 656,000 men were in the armed forces, a near doubling of size since
the start of the Pacific War. Between 1939 and 1945, 90% of Australia’s total production of
iron and steel was used for war. There was also an enormous push to expand the
infrastructure of the country and accommodate the arrival of American troops, whose

11 Cronon defines “first nature” as “original, prehuman nature” and “second nature” as “the artificial nature that
people erect atop first nature”. William Cronon, *Nature's Metropolis: Chicago an the Great West* (New York:

12 "Post-War Planning - Australian Reconstruction - Scheme presented to premiers," *Northern Miner*, February
3, 1941.


14 D.P. Mellor, *The Role of Science and Industry*, vol. 5, *Australia in the War of 1939-1945* (Canberra:
Australian War Memorial, 1958).
numbers in Australia had grown to 100,000 by May 1942. The Allied Works Council (AWC) was formed to look after military construction projects. As Goad and Willis note:

In Australia alone, construction completed amounted to 300 airfields, forty-seven of which were for the US Army, camping for staging ten divisions plus camps for base troops, 8000 km of roads, 11,000 hospital beds, and more than a million square metres of covered storage.\(^\text{15}\)

While industrial production increased, the change to a war footing generated three interrelated crises in materials, labour and housing. Australian industry was nationalised and directed towards military requirements, with increasingly severe restrictions placed on civilian construction.

First, civilian construction was gradually curtailed to free up labour and materials for the war effort. Initially this disproportionately affected architects rather than builders, since the number of small projects increased but that of larger, architect-led ones decreased. Restrictions were first introduced in December 1940 in the form of Commonwealth building regulations. The regulations prevented any civilian construction above the value of £5000 without a building permit from proceeding without the express consent of the Treasurer.\(^\text{16}\) The restrictions were progressively tightened at six-monthly intervals between June 1941 and June 1942 as material and labour supplies dwindled, until the Commonwealth effectively banned all construction worth more than £25.\(^\text{17}\)

The government sought to redirect labour away from non-essential civilian projects to help with the war effort. This happened within the architectural profession as well as within construction firms. Queensland architects complained bitterly that, of all the professions, theirs was affected the most by war-time restrictions. In fact, they noted in their report for the year ending in 1941 that, between June 1940 and June 1941, there was a 14.75% increase in construction output but a 23% decrease in architectural work.\(^\text{18}\) Building regulations reduced

\(^{15}\) Philip Goad and Julie Willis, "Invention from War: A Circumstantial Modernism for Australian Architecture," *Journal of Architecture* 8, no. 1 (2003), 45.

\(^{16}\) "Building Expenditure Regulation," *Courier-Mail*, November 19, 1940.

\(^{17}\) "A.R.P. Works Hit by Ban on Building," *Courier-Mail*, June 23, 1942, 3.

the work private architects could do to small houses and alterations and additions, but architects’ services were often not needed on smaller construction projects. In addition, architects in private practice received very few government contracts. Despite the threat of aerial attack by the Japanese throughout Queensland, few people turned to architects to assist with the design of domestic air raid shelters. Many firms closed during the war and architects left to find work with State and Commonwealth government public works departments or the military.19 Architect-designed private housing ground to a halt.

Second, there was a series of material crises as imports of goods were reduced due to the war and locally produced materials were commandeered for war production. Even the production of galvanised iron, the *bête noir* of reformists, was both restricted and diversified. Each restriction placed pressure on the production of its substitute, which rapidly and radically changed the range of building materials available. It became harder to obtain anodised galvanised iron, the use of which was restricted to water-catchment. Terne-coated iron was brought in for all other uses. This too was soon in short supply, so that only unfinished corrugated steel remained on the market. This had to be painted to give any protection and it soon became difficult to obtain any paint. Asbestos cement was seen as a possible substitute for galvanised iron and would figure heavily in post-war planning.

Before the war, most of Australia’s building timber was imported from either Europe or the Pacific coast of Canada and the USA. Fighting in the Pacific and Mediterranean, however, greatly disrupted merchant shipping routes and Australia had increasingly to rely on its own native forestry.20 Although knowledge about Australian timbers was still in its infancy, a series of war-time standards helped to create the conditions for substituting indigenous timbers for exotic ones. Structural research also enabled engineers to design with smaller cross-sections of timber, thereby improving the material efficiency of construction. Material efficiency, standardisation, substitution and scientific testing would become the buzzwords of architects and post-war planners, who put their faith in these processes to solve any future material crisis.


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20 For a more detailed analysis about how the war fostered innovation in timber architecture in Australia see Goad and Willis, "Invention from War," 41-62.
Third, the movement of people to cities for war work in parallel with the curtailment of civilian construction produced an accommodation crisis that became increasingly severe throughout 1942 and 1943. House construction at the end of the 1930s was only starting to recover after the lean years following the Depression, but faltered with the introduction of building regulations. The populations of Brisbane and Townsville swelled with the massive increase in American and Australian troops as Queensland became the base for American operations in the Pacific. Between 1939 and 1943, Brisbane’s population increased from 335,520 to 500,000, while Townsville’s grew from 31,414 to 90,000; in Townsville’s case, soldiers eventually outnumbered civilians by three to one. Newspaper reports from the time paint a picture of housing shortages exacerbated by an increase in war workers in cities, a lack of hotel rooms due to their occupation by the military, and the migration of rural families to the city as discharged rural soldiers obtained positions in Brisbane. Though the State government promised new housing and hostels to accommodate war workers, it was slow to respond. Near Brisbane, construction of housing for war workers at Rocklea, where many of the main munitions factories were located, only began in 1944. Those not involved in war work were advised to leave Brisbane and move to the countryside. Many who left and leased their homes, found that they could not move back to them, as their tenants refused to leave. Evidence given to the CHC in Brisbane in June 1943 showed that war work in the cities led to rural families either being split between the city and countryside or living in overcrowded conditions.


23 "Commonwealth War Housing Trust Answers Critics of Rocklea Homes," ABJQ 23, no. 266 (August 1944), 31.

24 The Architecture and Building Journal of Queensland, reporting on the Commonwealth Housing Commission in Brisbane, highlighted the difficulties families faced with accommodation. Two families often shared a house,
building, government officials struggled to find ways to accommodate the increased population in the city. Like the relaxation of standards for materials, occupancy standards were also relaxed as officials looked for social solutions when material solutions were impossible. A Brisbane housing survey from 1942 found overcrowding in 6% of accommodation, with only 2% of dwellings unoccupied.\(^{25}\) The Deputy Director of the Department of War Organisation in Industry, economist Colin Clark, still had faith that overcrowding would be reduced by home-owners leasing any spare rooms or dwellings. With tenants’ rights particularly strong, however, he struggled to convince owners of large houses to rent out parts of their homes to families in need or to secure any increase in the occupancy rate.

Accordingly, as post-war planning started to gain traction in 1943, Australian cities were severely short of accommodation, materials and labour. Clark was concerned that Queensland would not have the capacity to repair its housing stock and meet the pent-up demand for new homes if housing standards were raised. “Our housing standards are in need of improvement”, he told the CHC in Brisbane, “but the year the war is over is not the time to set about a scheme for the all round improvement of standards”. Instead he believed that “in the first year or so after the war, you would encourage the people to build a very cheap type of house”.\(^{26}\)

Medical officials would choose to ignore the economic and political reasons behind this situation, and concentrate their efforts on ensuring that any future housing would be of an adequate standard. The architectural profession, on the other hand, was quite ready to deal with the likely economic constraints facing post-war reconstruction. It advocated greater emphasis on off-site construction methods and research to test the feasibility of new building methods, the development of standards and the provision of advice to government and the building industry. Though the profession itself had been heavily affected by the war, it

leaving children to sleep in the living room. In other cases, parents moved to the city, living with friends while leaving their children behind with friends and family in the country. "Housing Inquiry," *ABJQ* 22, no. 253 (1943): 2.


\(^{26}\) Colin Clark, Queensland Bureau of Industry Witness C Clark Pages 242-278, 31st August, 1943, Collected Evidence for Housing Commission Report, NAA: A11625, Z176, National Archives of Australia, Canberra. 261
envisaged a much more regulated industry in the aftermath and lobbied government for an expanded role for architects not just as building designers but also as physical planners and building surveyors. At the same time, it wanted to see greater regulation of builders and the elimination of casual labour. The Institute, initially at least, was in favour of factory-produced housing. In part this was to ensure that the remaining capacity of the building industry would be devoted to buildings other than housing.

The Queensland Tropical Housing Committee

Alongside these developments in the architectural profession and the various industries on which it relied, the question of the tropical house was also being advanced. In March 1942, one month after the bombing of Darwin, Queensland Premier Frank Cooper appointed a committee to investigate tropical housing—the Queensland Tropical Housing Committee mentioned at the beginning of this chapter. The QTHC brought together experts in housing, tropical physiology, public health and economics to advise on future research into tropical housing in Queensland. The committee was led by Colin Clark, director of the Bureau of Industry, who at the time was considered the foremost economist in Australia. Joining Clark were Leo O'Connor, Sir Raphael Cilento, Douglas H.K. Lee, Robert P. Cummings and E.J.A. (Edward) Weller. O'Connor had a background in finance, was the manager of the State Advances Corporation and was responsible for administering Queensland’s housing program. Cilento and Lee were, as noted in Chapter 3, both medical men and firm advocates of tropical settlement. At this time they worked together as members of the National Health and Medical Research Council committee on nutrition and were colleagues in the medical school at the University of Queensland. Cummings and Weller were both architects and active in the Queensland chapter of the Royal Australian Institute of Architects. Cummings also taught students in architecture at UQ.

27 Bureau of Industry, Report of Committee on Tropical Housing 6th May, 1943, NAA: A11625, Z174, National Archives of Australia, Canberra. 1

28 Macintyre, Australia’s Boldest Experiment, 69.
Unlike past interdisciplinary attempts to study tropical housing, all members (excepting O’Connor) had studied or worked with some of the best international proponents in their field. Clark had studied at Oxford and, after graduation, worked as a lecturer at Cambridge University on the recommendation of John M. Keynes. Cilento and Lee had separately studied in London and had spent time in Malaya and Singapore, respectively, before returning to Australia. The architects also had some worldly experience and were committed, if relatively conservative, modernists: Between 1924 and 1930 Cummings studied and then taught at the Architectural Association in London while Weller, though he had not studied abroad, gained insight into the Chicago Prairie School while articled to Walter Burley Griffin in Sydney.

Unlike Matthew Nathan’s inter-war committees on tropical housing, however, this new effort included no representatives from women’s groups. In the midst of war, there was little scope for Nathan’s earlier vision of civil society and government joining forces to solve the “problem” of tropical housing. Architects and doctors still came together, but not countrywomen or members of any other community-led organisation, whose seats at the table were now occupied by economists and financiers who led a technocratic, all-male committee. With the exception of Weller, all were in public positions in either universities or government departments. Left in the hands of technical experts, tropical housing was no longer an activist concern, but a mechanism of state defence.

Before the war, in the late 1930s, governments in Victoria, New South Wales and South Australia set up commissions and housing boards to inquire into the state of housing


for the urban poor and, ultimately, to improve public housing. These bodies were most concerned with metropolitan areas. Queensland did not see the same agitation for public housing that was commonplace in Sydney and Melbourne, as the state had been providing low-cost homes through the State Advances Corporation since 1916. Such new powers as were provided involved public works rather than private housing. Unlike their southern counterparts, Queensland officials were not concerned with urban slums. In 1939, the State capital, Brisbane, had a population of only 326,000, which was typically considered too small to have attendant problems with slums. Instead, officials feared sub-standard housing in the tropics, and continued to believe that poor housing conditions were the main impediments to a stable population in northern Queensland.

On paper, the composition of the QTHC appeared to give equal weight to economics and finance, public health and architecture. Initially the Committee worked together to develop design principles that both improved the standard of tropical housing and made it more affordable. The QTHC tested its early ideas on tropical housing with presentations by Clark, Cilento and Weller to the Royal Society of Queensland in December 1942. A committed agrarian, Clark outlined a post-war dream of decentralisation and high home

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33 Alan Hutchings, "From Theory to Practice: The Inter-War Years," in The Australian Metropolis: A Planning History, ed. Stephen Hamnett and Robert Freestone (St. Leonards, NSW: Allen & Unwin, 2000), 75.

34 For example, Raphael Cilento and R.H. Robinson, when asked by the Housing Commission, in July 1943, denied that Brisbane had any slums like those found in Sydney or Melbourne. In contrast they thought that 20 percent of houses in North Queensland were below standard and that half of them should be demolished. Queensland Dept of Health and Home Affairs Witness R.H. Robinson & Sir Raphael Cilento, Commonwealth Housing Commission Summary of Evidence, August 31, 1943.


37 No mention is made of coastal cities in the ABJQ report on Clark’s presentation. "Big Outback Cities Expected After War," ABJQ 12, no. 246 (December 1942): 12.
ownership where tropical cities rose up in the outback. For this to happen, he predicted, houses would need to be built for £300 each, considerably lower than the average cost of a Queensland home (£488) in 1939-40. Surprisingly, given its popular association with overcrowding, Cilento reluctantly favoured “communal housing”, provided it came with suitable community facilities. During the inter-war period, Cilento had never publicly come out in favour of shared living arrangements. His section on housing in The White Man in the Tropics consisted solely of single-family dwellings, while his collaboration with J.V.D. Coutts in 1934 made no mention of flats. This shift in Cilento’s position was most likely due to Weller’s influence. Prior to the outbreak of war, Weller was one of Brisbane’s

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38 This figure is based on Clark’s average house building statistics for 1939-40 as given to the Commonwealth Housing Commission in 1943. It should be noted that houses in Queensland cities cost even more to build (£629 in Brisbane and £516 in other cities.) Only the houses built in the rural shires at an average of £357 came close to Clark’s ideal figure of £300 per house. Clark noted that the cheapest houses were only possible as they were largely self-built and made use of recycled material. Clark, Queensland Bureau of Industry Witness C Clark, August 31, 1943, Collected Evidence for Housing Commission Report, 252-53.


40 Another possible candidate is Oswald Barnett, but this is less likely as the Victoria Housing Commission favoured semi-detached dwellings rather than multi-storey apartments. Nor was Cilento’s opinion a popular one in medical circles, diverging even from that of his wife, Lady Phyllis Cilento, who condemned flats as being bad for children’s health due to their supposed lack of space for play. By the end of the year, Raphael Cilento appeared to be ambivalent about communal dwellings. In his report on post-war housing for the NHMRC, prepared with E. Sydney Morris, he contrasted the advocacy of three storey apartments in the British report on “Design of Dwelling Houses” with a lengthy critique of flats from 1930 by Sir Ernest Simon and J. Inman. Although Cilento and Morris did not elaborate a firm position on flats and they did not reject flats outright, they were more than happy to draw attention to the building type’s supposed shortcomings, such as the noisiness, lack of privacy and lack of play spaces in individual apartments. Simon’s and Inman’s quote positioned flats as a possible solution to housing the elderly, the unmarried and ‘childless couples’. Although Cilento did encourage better housing for the elderly, he never particularly cared for childless couples or the unmarried, instead placing a high value on reproductivity as the essence of citizenship. From Cilento’s viewpoint, which sought to encourage white settlement and population growth, the flat went against the norms for the reproduction of the settler body. As Cilento and Morris noted in their report: “The men and women who are essential to industry, which is the lifeblood for national survival in a material sense, should be so conditioned domestically as to seek rather than to avoid parenthood – the lifeblood for national survival in the human and
foremost advocates of apartment dwellings, attempting to popularise their adoption as a sophisticated housing solution through regular illustrated articles in the *Brisbane Daily Telegraph* and speculative projects that garnered considerable local attention. He had even gained some press attention for his conversion of a pair of houses into flats in Townsville. Cilento’s advocacy of communal housing signalled an interest in finding economic solutions to tropical housing. At that first public presentation, the development of healthy, affordable and modern designs for tropical housing appeared inevitable. Yet this inter-disciplinary collaboration of experts would be short-lived.

By January 1943 the QTHC was dominated by medical and economic interests, each pushing in opposite directions. The two architects, Cummings and Weller, did not publicly align themselves with either faction within the Committee and remained largely in the background. Cummings had been nominated to this body by the Board of Architectural Studies of the University of Queensland, Weller by the Queensland Chapter of the Royal Australian Institute of Architects. Cilento and O’Connor rarely made their presence felt, leaving the two youngest members (Lee and Clark, then both 38 years old) to fight the battle of shaping the group’s position on tropical housing.

Their positions illustrate the competing medical and economic visions for the post-war tropical house. Clark, who was also the Deputy Director of War Organisation in Industry, was the face of austerity in Queensland. Grappling with an accommodation crisis in the main cities in Queensland, he placed more importance on improving access to housing than on improving standards as such. This placed him at odds with those of his colleagues who sought to improve the minimum standard of tropical housing. In an article in Brisbane’s *Sunday Mail*, 6 June 1943, 6.

Raphael Cilento and E. Sydney Morris, "Housing and Health," in *Report of the National Health and Medical Research Council 16th Session, 1st-3rd December* (Canberra: NHMRC, 1943), 40, 42.

41 For a more extensive discussion of popular attitudes to flats during the interwar years, and Weller’s attempts to popularise their adoption, see Helen Bennett, "Interpreting the Modern: Flatland in Brisbane, 1920-1941, Living in Multiple-Occupancy Dwellings in Interwar Brisbane," PhD diss., Griffith University, 2010.

42 Weller was highly critical of Clark as the war drew on, penning a letter to the editor of the Brisbane *Telegraph* in which he complained about being “wedded to an economist dictated mediocrity”. E.J.A. Weller, "Housing Standards," *Telegraph*, March 8, 1945.
Sunday Mail in early 1943, Lee took a veiled swipe at Clark’s ideas. Lee blamed short-term economic thinking for the failure of past settlement schemes in northern Queensland. In Lee’s post-war vision, consumerism and nationalism would come together to bring physiological comfort to tropical settlers. He was aware of the role that lifestyle and aspiration played in changing popular taste. While decrying the adoption of southern fashions in tropical homes, he also contended that tropical luxuries would become standard in the future. The nation had to find ways to make air-conditioning, refrigerators, washing machines and built-in kitchens an expected part of the tropical home. Already Lee was pointing to a post-war future where home appliances would solve every lifestyle inconvenience—a population-wide adoption of the lessons of the Kissing Point Huts considered in the previous chapter. In contrast Clark sought to maintain the status quo of a highly regulated housing market, but one capable of delivering a large number of low-cost units.

The QTHC’s Report on Tropical Housing, dated May 1943, further highlighted the tensions between tropical housing improvements and projected immediate post-war tropical housing delivery. It was divided into four sections which introduced the Committee, set out fundamental physiological, hygienic, construction and economic requirements for tropical housing, assessed the contemporary position of tropical housing and gave recommendations for future action. Parts of the report emphasised the tropics as a set of social conditions—the lack of servants, the good working conditions for labourers and poor ones for housewives. Other parts emphasised climate conditions, in particular the problem of overheating. Still, there was a slight ambivalence in the report about the geographical scope of “tropical housing”. No maps were included, nor was “tropical Queensland” defined, and a number of claims referred to the state as a whole rather than to the tropics per se. Statistics on future housing requirements were given for all of Queensland, rather than just that part north of the Tropic of Capricorn. “Queensland has many climates,” the report noted, “and housing design must adapt itself to these”—a point reiterated in public by Lee in January 1942. The belief that building design should account for the climatic nuances of its region, in the tropics or

43 "Claimed Bad Housing In Queensland: Health in Homes is Professor's Plan," Sunday Mail, January 10, 1943.

44 Bureau of Industry, Report of Committee on Tropical Housing, May 6, 1943.

elsewhere, was an approach to which many architects would return as post-war planning progressed.

The fundamental requirements for tropical housing offered two different civic visions—one of universal health for the settler body and another of universal housing. According to the report, house design had an important role to play in improving health, by reducing the fatigue of the overworked housewife and providing hygienic food storage. Apart from the housewife, no mention is made of design problems specific to any particular group. Some of the committee’s recommendations, such as the need for careful orientation, had little to do with economics, but many of the expected improvements, such as labour-saving devices or refrigeration technologies, involved additional expenditure. These, the QTHC claimed, would also improve civic pride and domestic working conditions, therefore making tropical life more attractive.46

On the other hand, the report estimated that for housing to be affordable, repayments had to be kept to 15 to 20% of a man’s weekly wage. Over a twenty-year mortgage, this suggested that houses needed to be built for between £300 and £600.47 There was a prevailing belief in government not only that planning and centralised control were necessary to prevent a chaotic transition from a war-time economy to a peacetime one, but also that it was up to the experts to define a new minimum standard for housing. Housing had to be affordable to bring it within reach of low wage earners, but it also had to be attractive and promote health,

46 The report continued to distinguish tropical housing from the rest of Australia on the basis of climate, the supposed difficulty of obtaining servants and the differences in working conditions between housewives and labourers. See Bureau of Industry, Report of Committee, 3.

47 Bureau of Industry, Report of Committee, 4. The formula linking weekly wages and the cost of the house was not explained in the QBI’s report. I have extrapolated their assumptions based on evidence given in July 1943 to the CHC in Mackay by the town clerk, W. Weir. He included calculations to determine what low wage earners could afford to pay for a house and explained how he arrived at a maximum cost of £300 for a property. Like the QBI he assumed a similar ideal repayment rate of a day’s weekly wages (i.e. 15-20% weekly wages based on a five to six day working week). His formula was based on weekly wages of five pounds, an interest rate of 4.5% and a twenty-year repayment period, “resulting in an upper value of no more than £300” for a property. This proposed cost is the same as the lower price point given by the QBI, suggesting that the QBI also were working on the basis of weekly wages of around five pounds to afford a mortgage for a £300 house and therefore a wage of ten pounds for a £600 house. “Cheaper Homes for the People Sought,” Daily Mercury, 16 July 1943, 5.
to induce tropical residents to remain in the north. The report estimated that over 78,000 houses in Queensland would be needed by 1950 to absorb anticipated population growth, while at the same time it predicted material and labour shortages following the war. The QTHC, however, admitted that it was unlikely that one could build its minimum standard of house—an insulated, timber-framed, well-ventilated dwelling, of sufficient size, that could be partially air-conditioned and had piped water—for less than £600, let alone £300. Rather than the government subsidising the cost of new homes, the QTHC favoured the nationalisation of the building industry and the standardisation of building components to keep costs low. Prefabrication was another option. The QTHC recommended the adoption of a limited number of standard designs with regional adaptations for climate. This, however, reduced the role of architects to that of (at best) site supervisors, and it was not long before Weller began to go to the Queensland press to publicly question the practicalities of prefabrication and standardisation.

Because the QTHC’s report maintained a distinct separation between the economics of housing and the provision of comfort, there was only limited discussion of precisely how its vision was to be made an affordable reality for poor labouring families. The discussion on tropical housing was largely consistent with the national discourse on rural reconstruction, which sought to find ways of improving rural living standards and stopping the drift from the countryside to the city. The QTHC believed that architecture had to encourage “residential permanence”, showing that encouraging settlement, or at least ensuring people remained, was a priority. To reduce costs, the architecture subsection did mention prefabrication as a possible solution. None of the concluding recommendations, however, dealt directly with proposals to make housing cheaper. Most of the recommendations dealt with mechanisms to research, control and publicise better standards for tropical housing. In particular, the QTHC seemed most anxious to establish itself on a permanent basis, with a budget and personnel. It


49 "Housing Test Criticised," Courier-Mail, June 15, 1943.

50 For an outline of war-time discourse on rural reconstructions see Macintyre, Australia's Experiment, 168 - 175

51 Bureau of Industry, Report of Committee, 3
recommended the formation of a Technical Advisory Committee which, alongside the existing members, would include representatives from the Public Works Department, Institute of Engineers and Master Builders Association. This Committee would be entrusted to undertake a number of tasks:

(i) abstract and duplicate abstracts from technical literature;
(ii) prepare plans and diagrams;
(iii) carry out laboratory tests on materials and structures;
(iv) carry out field tests on proposed designs and materials;
(v) prepare pamphlets, brochures etc. for public presentation;
(vi) assist in the preparation of public demonstrations.

While these actions could have led to cheaper buildings, the recommendations did not frame them that way. Instead they noted that “whatever solution to the problem is envisaged, the Committee recommends in the strongest possible terms that adequate steps be taken to control all new building and adapt design to tropical requirements”. In other words, irrespective of costs, comfort or design, the official discussion on tropical housing mostly concerned the control of standards.

Tropical exceptionalism continued to maintain a distinction between the problems faced by the rest of Australia and those that specifically confronted the tropical north. It was not apparent from the report that most metropolitan cities in Australia were also facing a housing crisis or that there was already considerable movement in the southern States to find ways of making housing more affordable. The report came at a time when Oswald Barnett, 52 Colin Clark, et al., Draft Report on Tropical Housing, February 24, 1943, Raphael Cilento Papers, UQFL 44, 108, Fryer Library, University of Queensland.

53 For example, the Victorian Housing Commission had already received considerable attention for its slum clearance and housing programs. In 1942, two of the program’s chief instigators, Oswald Barnett and W.O.Burt, collated their experience in the booklet, Housing the Australian Nation, which acted as the blueprint for the later Commonwealth Housing Commission. Although the booklet was most concerned with making the case for slum clearance and setting out different ways to finance a nationwide program of house-building, it paid attention to effective strategies to reduce housing costs, including mass production, standardisation and semi-detached houses. A number of these homes were erected using the Fowler system of tilt-up concrete construction, which also received considerable attention in the press and in Barnett’s and Burt’s own book. Barnett did not suggest
the Methodist housing reformer, and lawyer Oswald Burt, were pushing for a nationwide approach to post-war housing. Spurred on by the success of the Victorian Housing Commission, Barnett and Burt aimed to use their experience of rehousing Victorian slum-dwellers and providing low-cost housing as a blueprint for housing the nation. Yet though Barnett and Burt addressed questions of space standards, costing and housing delivery, there was little mention of the thermal conditions that would be fundamental to any solution rolled out in the tropics. The QTHC’s report was distinctive in its emphasis on physiology as the key to the success of any future housing scheme.

Ultimately the QTHC had limited power, acting in an advisory capacity to the minister and receiving too little funding to develop any comprehensive proposals. The QTHC’s report of May 1943 failed to secure permanent standing for the Committee. By then, attention had shifted away from State committees to the newly formed CHC, set up to inquire into the state of housing in Australia and develop proposals for post-war housing schemes. It was chaired by one of the QTHC’s members, Leo O’Connor, who continued to seek a role for the QTHC within the CHC, but with only limited success. To an extent, the failure of the QTHC to capitalise on its efforts was a product both of competing disciplinary interests and ideologies about the future needs of society, ranging from civic urbanism to remote agrarianism, within the committee and of a shift in emphasis on housing research. No longer a matter for individual states, it had become subject to a tightly coordinated nationwide approach.

that cost reduction alone would allow more houses to be built. Instead he suggested the Commonwealth provide financing of £15 million per annum to build a projected quarter of a million homes over the following ten years. This would have amounted to £600 pounds per house, a more realistic proposition than Clark’s £300 home. Burt and Barnet had attracted attention for their work with the Victorian Housing Commission. They had already shown that mass production, standardisation and semi-detached housing could reduce the costs of housing by approximately £2/m² (they claimed £20/100 sq. ft) allowing brick homes for six people to be erected for £622 in 1940-41. See Oswald Barnett, “Housing the Australian Nation,” _ABJQ_ 21, no. 247 (January 1943): 3-11; F. Oswald Barnett and W.O. Burt, _Housing the Australian Nation_ (Melbourne: The Research Group of the New Left Club, 1942), 68-69.
Housing as Social Security

The CHC was the institutional expression of the belief that “better homes help make better citizens”\(^5^4\) and that a decent home was the right of every citizen. Housing was seen as a key pillar of social security and necessary to alleviate poverty. Since 1941, the Parliamentary Committee on Social Security had recommended the formation of a Housing Planning Authority. The initial premise for the Commonwealth’s involvement with housing provision was set out in the introduction to the Committee’s Fourth Interim Report, from May 20, 1942, which dealt exclusively with housing:

> It is very doubtful whether in any instance in recent years, housing activities in any State have anything like kept pace with current demands, and in none can it be said that arrears have been overtaken or any considerable approach made to a solution of this problem, which must necessarily envisage adequate and healthy housing conditions and living space for the whole of the Australian people. Without the provision of housing for all on such a scale we cannot hope to establish and maintain proper standards of public health, child welfare, and morality, which are prerequisites to the building up of a healthy, virile and great people.\(^5^5\)

Housing was regarded as necessary to reduce unemployment and crime and to improve public health. In the Committee’s report, the problems supposedly associated with poor housing—delinquency, overcrowding, ill-health and poverty—were considered largely a symptom of inner city living. While it acknowledged that some States provided some form of financial assistance to enable low-waged workers to access a home, the report showed that this assistance was far from uniform across the country.\(^5^6\) As the Fourth Interim Report from the Joint Committee on Social Security noted, however, while the State housing boards were able to clear slums and build new homes, they did not do this at a scale anywhere near sufficient to eliminate the housing shortages that had existed since the Depression.\(^5^7\)

Although most State housing commissions had conducted surveys of housing conditions in

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\(^5^4\) Barnett and Burt, "Housing the Australian Nation," 5.

\(^5^5\) "Fourth Interim Report from the Joint Committee on Social Security" (May 20, 1942), Commonwealth Parliamentary Papers 2 (1940-43): 787.


\(^5^7\) “Fourth Interim Report,” 6. More recently, Stuart Macintyre makes a similar point about this period. Macintyre, Australia’s Boldest Experiment, 176.
metropolitan areas, the Committee had only limited evidence for Queensland and Western
Australia (and, therefore, for northern Australia) and also lacked evidence for rural areas
throughout the country. Nor was there a clearly defined, minimum standard of housing
legislated throughout Australia. Housing was treated by the Committee as a national and
largely homogenous concern, which offered “hygienic conditions and … wholesome
surroundings” for families, particularly those on a low income. There was also growing
concern for how best to avoid unemployment when soldiers were demobilised, and housing
was presented not just as a public right, but also as a form of public works and unemployment
relief.

In late 1942, under the category of “social security”, the Commonwealth government
sought to consolidate its war-time emergency powers into a post-war future, including the
power to make laws concerning “national health and fitness, housing of the people and child
welfare”. These powers were debated in November 1942 and resulted in the creation of the
Ministry of Post-War Reconstruction, responsible for housing. The federal government,
however, was not able to completely wrest responsibility for housing away from each State,
so State committees continued to provide advice to their own government. The QTHC
increased its activity in early 1943, immediately following the Commonwealth’s failed
attempt to take responsibility for housing away from the States. In the face of an ever-
increasing housing shortage and recognition that planning for post-war peace would take
time, the CHC was formed in April 1943.

58 The committee made no mention of the Northern Territory either, likely due to the Territory’s very small
non-Aboriginal population, which numbered only 4,850 in 1933, the last time the census was taken. For
population statistics see Ronald Wilson, Commonwealth Year Book 37 (Melbourne: Commonwealth Bureau of
Census and Statistics, 1946-7), 700.

59 "Fourth Interim Report, " 3-4.

60 "Sweeping powers proposed for commonwealth to achieve war aims and post-war objectives," Argus,
October 2, 1942, 3.

61 Macintyre, Australia's Boldest Experiment, 179.
The Commission was hardly an eminent group, its members chosen more to balance regional and departmental interests than for their innovation. It was chaired by Leo O’Connor of the QTHC, who was joined by two Melbourne-based architects, a nurse from rural New South Wales and a South Australian politician. The architects were John Gawler (an academic also involved in architectural politics) and Charles Howard (an officer in the Department of the Interior with an interest in tropical housing). Albert Thompson was an Australian Labor Party politician who represented Port Adelaide in the South Australian House of Assembly; Mary Ryan was a left-leaning nurse brought in to ensure popular support for the Commission. While the Commission did not have the international experience that Clark, Cilento and Lee brought to the QTHC, it was ably supported by a young, ambitious team of executive and research officers. It was they who gave the Commission its intellectual ambition.

Walter Bunning, the Commission’s executive officer, had started out with leading Australian architects Stephenson and Turner and then gained international experience in Dublin and London, working on pavilions for the 1939 New York World’s Fair, a showcase of modernism in the United States. He was also a founding member of the Modern Architectural Research Society in Sydney, set up along similar lines to its better known counterpart in London. The Commission’s secretary was Willmott Phillips, a highly regarded economist. Joining them were two young research officers: Grenfell Rudduck, an

62 Macintyre, Australia's Boldest Experiment, 40.

63 Howard would later play a significant role in the planning and design of both Darwin (1946) and Woomera (1947) where he implemented many of the principles of the CHC following a tour of the United States and Brazil. See Christine Garnaut, Iris Iwanicki, and Robert Freestone, "Modernism in the Desert: The Planning and Design of Woomera Village 1947-1967" (paper presented at Panorama to Paradise: the XXIVth International Conference of the Society of Architectural Historians, Australia and New Zealand, Adelaide, Australia, 21-24 September 2007), cd-rom.


65 For a history of MARS in Australia see Michael Bogle, "Arthur Baldwinson: Regional Modernism in Sydney 1937-1969" (PhD diss., RMIT University, 2008), 188-207.

66 Macintyre, Australia's Boldest Experiment, 180-81.
architect who would go on to play a leading role in the planning of the Australian National University, and John Oldham, also a Stephenson and Turner alumnus. Among their most significant early achievements was the establishment of the Building Research Station.

Bringing the House into the Laboratory

The idea for a building research station occurred almost simultaneously to two separate Commonwealth bodies—the CHC and the Allied Works Centre (AWC)—in May 1943, shortly after the formation of the CHC. The AWC was responsible for designing all military installations throughout Australia. Officials at both the CHC, based in Sydney, and the AWC, based in Melbourne, were aware that the Melbourne architect Leighton Irwin was trying to offload his own testing laboratory. Both agencies were interested in acquiring it. Irwin’s laboratory, which a visitor described as “a furniture manufacturer’s shop with good machines”, had been used to develop a demountable hut for the Australian Army. Both the CHC and the AWC were faced with the problem of producing buildings quickly and with fewer materials. The CHC envisaged at least 40,000 houses per year would be needed nationally.

Prefabrication, standardisation and mass production were all considered innovative solutions to this crisis of time, material and money. Charles Howard of the Department of the Interior, who was appointed to the CHC, thought that prefabrication, despite general interest, had yet to take off for want of practical testing. He explained his thinking to John Crawford, director of research at the Ministry of Post-War Reconstruction while travelling with him on May 4, 1943. “In almost every talk or article on housing”, he summarised afterwards,

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“reference is made to prefabrication and mass production, but as yet, its possibilities have not been thoroughly investigated”.

To bureaucrats and committed modernists, prefabricated homes were an attractive expression of industrial progress and an economical solution that could reduce the cost of housing while maintaining jobs in industry after the war. Prefabrication became a catch-all term, with multiple interpretations. This 1944 description of prefabrication by Barnett, Burt and Heath captures both the range of its meanings and the naïve optimism that industrial methods would improve living conditions for all:

To some it may simply mean mass production of housing, to others standardised mass-produced parts ready for assembly on the job, to others again it offers possibilities for the production of low-cost housing of various types and sizes turned out like motor cars from the factory and simply transported to site – to all, however, it should mean cheap housing, with all modern amenities without a sacrifice in room sizes and general standards necessary for comfortable and healthy living.

The simultaneous interest of the AWC and the Ministry of Post-War Reconstruction in having their own laboratory pointed to a new emphasis on testing, certification and prototyping not only new materials but also new ways of assembling them. Though the Allied Works Council tried to use standardisation to keep costs down, this effect could be undermined in its local application, or overlooked through ineffective communication. As Charles Hoy, Assistant Director-General of Allied Works at the Department of the Interior, noted to the Director-General of the AWC, Ted Theodore:

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We have been designing and standardising on a broad basis and leaving it to our State Branches to adapt to local conditions. The local interpretation, however, at times defeats the economy we have endeavouring to obtain and conversely an improvement made in one State may not be available in the other.  

For those responsible for housing, the sheer scale of operations that came with planned post-war production was unprecedented. There was a predicted national shortage of over 300,000 homes by January 1945. This was blamed not just on the war, but on the inability of private enterprise to cater for the poor. “If the people are so poor that they cannot give private enterprise the financial inducement necessary to build”, Barnett and Burt argued in 1942, “then the Government must come to the aid of the people, and in larger measure than has ever before been imagined”. Bringing the house into the laboratory made sense to government officials who were desperate to find practical and economical solutions to a crisis of time, materials, accommodation and affordability. A minute to the Minister of Post-War Reconstruction, Ben Chifley, highlighted the need to rationalise existing methods of construction as well as develop new ones to reduce the construction cost of houses. Indeed, the scale of housing plans meant that small improvements in any of these areas were justified as having the potential for significant savings. “It will readily be seen that any method of simplification of construction or trade can be adopted which would reduce normal costs by as

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74 Barnett and Burt, *Housing the Australian Nation*, 63.

75 As well as proposing that the station study a range of methods to reduce housing costs for apparently universal application, a minute on the Experimental Building Station pointed to specific problems associated with finding material substitutes and developing houses for rural and tropical areas. It is interesting that the ‘Rural House’ and ‘Tropical House’ were considered separate problems, as Raphael Cilento had previously given evidence to the Housing Commission that the problems associated with housing in the tropics were most acute for rural residents. Perhaps the separation shows two different perspectives on climate— merely a backdrop for temperate residents, and hardly remarkable, but hazardous and needing to be controlled for housing in the tropics. See C.A. Hoy, Sir David Rivett, and H.C. Coombs, Minute: Experimental Building Station, November, 1943, NAA: A9816 1943/1009 Part 1, National Archives of Australia, Canberra; Queensland Dept of Health and Home Affairs Witness R.H. Robinson & Sir Raphael Cilento, Commonwealth Housing Commission Summary of Evidence, August 31, 1943.
little as £1 per dwelling, it would mean a saving of possibly £40,000 per year to Government housing alone.”76 Profound change was now seen as possible through focused experimentation with building processes, materials and forms. Some 60 years after tropical medicine began to answer questions of national importance through the laboratory, architecture was about to do the same.

Initially, the Building Research Centre was envisaged as a small workshop in Melbourne for testing experimental assemblies, under the joint control of the AWC and Ministry of Post-War Reconstruction.77 This suited the AWC, who were headquartered in

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76 Hoy, Rivett and Coombs, Minute

77 Corr. Hoy to Theodore, May 10, 1943. It seems probable that Hoy’s real intention was to help out Irwin, who held considerable power and influence in Melbourne’s architectural circles but could no longer afford to pay for his own laboratory. In exchange, the AWC gained Irwin’s backing in academia and in the profession. Hoy explains in his letter to Theodore: “[...] if we could obtain the active co-operation of Mr. Irwin Leighton [sic] himself on a part-time basis, we would thus achieve a contact with outside practice and the Melbourne University.” As Hoy developed the AWC’s proposal for a laboratory, Irwin sent him detailed requirements and costings on June 18. Irwin’s proposal sought to incorporate the laboratory within the AWC while allowing it to pursue independent inquiry. On July 16, Hoy wrote to the Director-General at the Ministry of Post-War Reconstruction, outlining the AWC proposal for a laboratory, closely following Irwin’s specifications. (Corr. Hoy to D-G, July 16, 1943, NAA: A11677 S1943/65 Part1). Then at a meeting with the CSIR, Housing Commission and Ministry of Post-War Reconstruction on July 31, Hoy proposed that any research centre maintain independence from the Commonwealth and obtain the services of “a private architect at a salary of £500 per annum for the use of one-third of his time.” In effect, Irwin would have received a guaranteed income and lump sum payment for his lab and retained his firm’s right to use the lab while making the Commonwealth responsible for all staffing costs, equipment costs, maintenance and rental. Research officials in the Ministry of Post-War Reconstruction, only found out about the extent of Irwin’s and Hoy’s co-operation in mid-July, on the same day as Hoy wrote to the D-G. (Crawford initialled Hoy’s May 10 letter to Theodore on July 16 and notes that he transferred it with Hoy’s permission from the Department of Interior file to the Ministry of Post-War Reconstruction file. He may also have included an extract of Irwin’s proposal, which did not include costings). Four days later, Ruddock pressured Crawford to counteract Hoy’s proposal, before Hoy received Ministerial approval. Ruddock’s handwritten comments on Hoy’s July 16 memorandum to the Assistant D-G (NAA: A11677, S1943/65 Part 1) indicate that he thought little of the proposal and that it had only a “limited conception of the functioning of the laboratory”. He informed Crawford that he was aware that Hoy had a more detailed proposal from Irwin. (Corr. Ruddock to Crawford, July 20, 1943, NAA: A9816 1943/1009 Part 1). In another memorandum, Ruddock told Crawford to question Hoy on what he thought Chifley’s reaction to Irwin would be (presumably as director of the laboratory). (Corr. Ruddock to Crawford, July 22, 1943, NAA: A9816,
Melbourne. This proposition, however, frustrated executive officers in the Housing Commission, who preferred to be able to test a wide range of materials and methods in close proximity to the Commission’s base in Sydney.78 Further, the location of another government building in Melbourne was considered politically unwise, as any further concentration of power in that city was viewed with suspicion by those from outside Victoria.79 Officials in the Ministry of Post-War Reconstruction were also concerned, secretly fearing that they would not have control of investigations if the centre were part of the AWC and worried about the negative publicity of being seen to affiliate with the deeply unpopular AWC.80

The development of the centre drew other actors into the discussion of the possibilities for a national building research facility; but it also troubled them. The Council for Science and Industry Research (CSIR) saw building research as part of its remit and was concerned by reports that the AWC and Ministry of Post-War Reconstruction were considering forming their own Building Research Centre.81 Officials in the Ministry of Post-

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78 Corr. L.G. Melville to the Director-General of Allied Works (undated draft), A9816 1943/1009 Part 1, National Archives of Australia, Canberra.

79 NSW’s federal MPs regularly decried Melbourne’s dominance of federal politics. In 1944, Charles Howard used developmental and defence arguments against locating the Experimental Building Station in Melbourne instead of Sydney after the war. At the outbreak of war the Headquarters of various Australian services were located in Melbourne, necessitating a concentration of such services as munitions, AWC, aircraft production, etc. For the future development of Australia, further concentration in Melbourne would be unwise, especially in view of the development of the more northern portion of Australia, which will be vital to the future defence of the country. See "Government from Melbourne retards war effort," *Canberra Times*, July 27, 1940; C.V. Howard, Experimental Building Station: Notes on the advantage of site for the Station being located in Sydney 8 July, 1944, NAA: A9816, 1943/1009 Part 2, National Archives of Australia, Canberra.


81 J.G. Crawford, Minute to Mr. Melville Re: Building Research Centre, August 3, 1943, A9816 1943/1009 Part 1, National Archives of Australia, Canberra.
War Reconstruction, however, were reluctant to hand over the running of a centre to the CSIR as they believed it lacked the funding, technical expertise and field experience necessary for testing construction assemblies. Instead, the Melbourne-based CSIR was brought into the discussions in August 1943.

Queensland Evidence on Tropical Housing

Further extending the reach of this exchange, just after officials began to discuss plans to develop a testing laboratory, members of the CHC toured the country, gathering evidence about the state of housing in Australia, identifying the country’s post-war requirements for housing and getting feedback on their own ideas (such as the lowering of ceiling heights to reduce construction costs) from a wide audience. The Commission’s experience in Queensland gives an insight into what the CHC thought about tropical housing and how their efforts and thinking related to those of the QTHC. Starting in Sydney on June 7, 1943, the Commission toured all of the states (although they avoided the Northern Territory), speaking with 793 witnesses and visiting 62 towns and cities. Unlike the QTHC, which relied only on the expertise of those on its Committee, the Commission sought out a wide variety of bodies to both inform them of the present state of housing and to give feedback on tentative ideas the Commission had formed about future housing. Witnesses ranged from the Old Age and Invalid Pensioners Association in Melbourne to the Dairymen’s Association in Innisfail,

82 Extract from "Minutes - Research Meeting," July 26, 1943.

83 Crawford, Minute to Melville.

84 Commonwealth Housing Commission, First Interim Report, 21st October 1943 (Canberra: Government Printer, 1943).

85 Macintyre gives a figure of 53 towns and cities and 948 witnesses (in Australia’s Boldest Something, 181), however the Housing Commission’s final report lists 793 separate witnesses (written and oral submissions) and mentions that the commission ‘took public evidence in each capital city and visited fifty-five selected towns’. Commonwealth Housing Commission, Final Report: 25th August, 1944, 157-63. Macintyre does not cite his sources for these figures, therefore I have taken the numbers from the Commission’s report.
Queensland. The Commission toured Queensland, taking
evidence in Brisbane, Cairns, Atherton, Innisfail, Ingham, Townsville, Bowen, Mackay,
Rockhampton, Gladstone, Bundaberg, Maryborough, Gympie, Toowoomba and Warwick.
At the sessions in northern Queensland, the general requirements for tropical housing were
regularly discussed, in particular the need for adequate equipment and low-maintenance
construction. The Commission took a much broader view of housing than the QTHC, placing
far more emphasis on regional and town planning and the administration of housing programs
than the QTHC, which largely viewed housing as a physiological and economic issue. It also
sought to create a uniform building code to raise standards across the Commonwealth, with
some allowance for climatic differences. In that regard there was a certain overlap with the
QTHC, which also thought that climatic differences in Queensland provided the basis for
regional variation. As the QTHC had made a start on defining future requirements for tropical
housing and claimed some understanding of its present state, both Clark and Cilento were
called to give evidence to the Commission in Brisbane on July 8. Clark had little to say on
tropical housing, but submitted the QTHC’s report. Cilento, who was still considered an
authority on tropical living, was gently quizzed by CHC chairman Leo O’Connor on his
opinions on tropical housing.

Both Cilento’s and Clark’s contributions reinforced their advocacy of the need to
prioritise rural housing reform and ran counter to the CHC’s emphasis on addressing a
metropolitan housing crisis. Cilento believed that 20% of rural houses in northern
Queensland were substandard and half of those needed to be demolished. He pointed out

86 For a full list of individuals and organisations who gave information see Commonwealth Housing
87 "Few Bathrooms in Country Districts," Courier-Mail, July 23, 1943; "Post-War Homes on All-Electric Plan
89 Queensland Tropical Housing Committee Witness Colin Clark, Commonwealth Housing Commission,
Summary of Evidence, August 31, 1943, Collected Evidence for Housing Commission Report, NAA: A11625,
Z174, National Archives of Australia, Canberra.
90 Queensland Dept. of Health and Home Affairs Witness R.H. Robinson & Sir Raphael Cilento, Summary of
Evidence, August 31, 1943, Collected Evidence for Housing Commission Report, NAA: A11625, Z171,
National Archives of Australia, Canberra.
the ways in which their planning and construction contributed to overheating and increased
the risk of tropical diseases. According to his rhetoric, the tropical farmhouse was
pathological. In contrast, he proudly noted Brisbane’s lack of slums. His written report,
submitted with R.H. Robinson, did not provide any information about where in the state bad
housing affected health, nor give the number of unhealthy dwellings. It seems likely the
figure of 20% was plucked from thin air. Yet it served Cilento’s purpose to position tropical
housing (rather than inner-city slums) as most in need of improvement. Cilento had, after all,
been advocating the reform of the tropical house for over 20 years, and had barely changed
his opinion.

Although Clark had been lead author of the Queensland Tropical Housing Committee
Report, his oral evidence to the CHC sought to dampen any expectations of rapid
improvements to housing standards. Concerned by the depreciation of existing building
stock, Clark thought that essential maintenance should happen first and only then should a
program of new building commence. He estimated this would take over two years. This was
not what the Commission wanted to hear and he was forced to admit to them that some new
building could happen in that time.

Clark did not think it wise to improve housing standards immediately after the war.
Instead, due to ongoing material and labour shortages, he thought people should build as
cheaply as possible, improving and extending their homes over time. He was not worried
about what ex-servicemen from the towns and cities would think of this. Priority ought to go
to rural veterans, he argued, as they could build for less. For ex-servicemen he thought that:

The men brought up in the big cities will demand fairly expensive houses but the men
brought up in the country will be accustomed to cheap houses. It is largely a question of who
should come first; and if a country-man can do it under £300, and the city man cannot do it
under £800, the country should come first.91

For northern Queensland, both Cilento and Clark favoured rural areas being given
priority for any post-war housing. Yet their rationales could not have been more different.

91 Colin Clark, Queensland Bureau of Industry, Witness C Clark (242-278), August 31, 1943, Collected
Evidence for Housing Commission Report, 261.
Cilento thought standards were poorest in the tropics and most in need of improvement, while Clark saw the advantage in this, since houses could be built for less. O’Connor was not so sure. He dismissed Clark’s claim that houses could be built for £300. In contrast to O’Connor’s gentle prodding of Raphael Cilento, his exchanges with Clark were terse, suggesting little by way of mutual fondness. Clark was rarely in agreement with the representatives of the Commonwealth Housing Commission. He was against centralised planning and he overlooked their fears that poor quality homes were a factor in rural depopulation. If anything, the potential for housing to motivate people, whether as a benefit for war-time sacrifice, a source of post-war work, or a means to keep people in the countryside, was completely lost on Clark. 

Still, the CHC expressed its interest in working with the QTHC, requesting any prior reports and investigations and notifying the QTHC of its plans to create experimental homes for testing. The exchanges between the two bodies hinted at the emerging shape of the CHC’s building research program.

Reading the departmental correspondence about the formation of the Experimental Building Station, one is struck by the tactical use of climate and the tropical house by officials like Leo O’Connor, Grenfell Ruddock and Charles Howard, to obtain the cooperation of their colleagues. The CHC had initially expressed interest in having the Experimental Building Station in Sydney, as that was where they were based. The eventual decision to build the station in Sydney under the control of the CHC, however, had as much to do with climate as with inter-departmental politics.

On July 31, 1943, representatives from the Allied Works Centre, CHC and Ministry of Post-War Reconstruction met to work out a proposal on how the station would operate and

92 Clark casually dismissed Commissioner Ryan’s question about whether soldiers would accept a poorer house and was uncommitted to ex-servicemen in the construction industry, in part as he did not think there would be much house-building immediately after they were demobilised. Although he was strongly in favour of rural decentralisation, he did not advocate the industrialisation of country towns as he thought that after the war, with the end of trade protections, Australian manufacturing would not be able to compete with cheap manufactured goods from abroad. Instead Clark appeared to believe that increased global demand for Australian primary produce along with political decentralisation would be sufficient to spur regional development. “Develop the country - not the cities - Economist's rejoinder to Mr Menzies,” Cairns Post, March 10, 1943.

93 Clark, Collected Evidence (QBI), 278.
what the scope of its work would be. As chairman of the Housing Commission, O’Connor
had only just returned from hearing evidence in Far North Queensland. He expressed his
preference for a research station in Sydney, “on account of its climate, which would make it
suitable for testing out buildings which exist throughout the Commonwealth.” Climate,
rather than departmental convenience, was used to justify the location of the station. Sydney,
as opposed to Melbourne or Canberra, was considered representative of the whole continent’s
climate. The AWC expressed some reservations, but its representative, Charles Hoy, admitted
he was open to the idea of the station being in Sydney. When the group met again the
following week, this time with members of CSIR, the whole group now agreed that:

Sydney was regarded as being most suitable from the point of view of testing, because
it possesses a mean temperature, although from the CSIR’s point of view it was not
particularly suitable for timber and chemical research.

It was only when there was a real prospect of the station being based elsewhere that
O’Connor used the supposed representativeness of Sydney’s climate as an argument for
locating it there rather than in Melbourne. Both the AWC and CSIR were based in Melbourne
and both initially argued for a Melbourne station. Sydney’s climate was emphasised on two
further occasions when the question of the location of the station was raised. Climate
therefore played a decisive role during negotiations about the location of the station, shifting
from being an item of little consequence to a resource to be exploited as a determining factor
of where and what kind of testing could take place. The seemingly objective value of climate
counteracted any opposition to the centre’s location.

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94 Report of a meeting held in the Department of Post-War Reconstruction, July 31, 1943, to consider the
Building Research Station proposal, A9816 1943/1009 Part 1, National Archives of Australia, Canberra.

95 Report of a meeting held at the Department of Post-War Reconstruction, August 6, 1943, to consider the
proposal for a Building Research Station, A9816 1943/1009 Part 1, National Archives of Australia, Canberra.

96 Report (August 6, 1943); Howard, Experimental Building Station: Notes on the advantage of site for the
Station being located in Sydney, July 8, 1944.
The Tropical House as a Tool for Collaboration

Between late August and March 1944, as the executive officers in the Department of Post-War Reconstruction and Housing Commission began to write up more detailed proposals for ministerial approval, the tropical house was presented as a potential project for the Experimental Building Station. In Sydney, the design of the tropical house was not considered a pressing national problem, and had not been a priority for the Commonwealth Housing Commission. Rather, it was developed as a tool for collaboration—a means of testing the division of labour in a research project or of working out how Commonwealth and State organisations might collaborate on problems of common interest.

Inter-departmental meetings concerning the Building Research Centre were held in August 1943, involving the CSIR, AWC, Department of Post-War Reconstruction and the CHC. They reached a broad consensus on the responsibility and aims of the Centre. To appease the CSIR, the name of the Centre was changed and responsibility for building research was split between the two organisations. 97 The CSIR would undertake material research while the Experimental Building Station would undertake construction research. 98 This division of functions appeared to maintain a separation between pure and applied research—building and materials science and their uptake in architectural design. 99


98 Report (August 6, 1943).

99 This split is significant as it set building research in Australia on a different path to that of its UK counterparts where, since 1921, a Building Research Station had been responsible for material and construction research, as a division within the (U.K.) Council for Scientific and Industry Research. It appears that the U.K.’s Building Research Station, despite its name, had only a partial influence on the formation of the Experimental Building Station. Although, in February 1944, reports on the structure, functions and development of the U.K. Building Research Station circulated among the executive officers in the Housing Commission, by this stage the basic structure and mandate of what had become known as the Experimental Building Station had largely been decided. It seems likely that the CSIR in Australia were more concerned that they would not lose funding for fundamental research on materials but had little interest in expanding into testing or developing material assemblies, due to staffing shortages which they faced at the time, a point raised by Dr Wark of CSIR at a meeting about the station on August 16, 1943. In the end, Leighton Irwin’s document on a proposed testing laboratory and the interdepartmental composition of the Housing Commission members as well as CSIR’s lack
While the government’s major interest in the station was to show how it would help the CHC produce lower cost homes, proposals also had to explain how the division between the CSIR and the Experimental Building Station would function in practice. The tropical house study was used as one of two examples to explain how the different parties would collaborate. Preliminary notes by Ruddock from September 1943 illustrate the prevailing view that the tropical house was largely a problem of environmental performance. In the first stage, the CSIR would “make available data on and investigate effects of tropical conditions on building materials”. In the second stage, a Design and Production Research Laboratory—the Experimental Building Station—would proceed from a study of “climatic conditions” and “environmental influences” before setting thermal performance and space standards, to be followed in turn by artificial weather tests and large-scale prototyping. Finally, designs would be simplified depending on whether on-site or factory production was chosen. This description of the research process emphasised a linear understanding of research with the sequential movement of the project from the CSIR (first stage) to the Experimental Building Station (second stage).

of capacity at that time were most influential. The legacy of the split in research focus has been hinted at by Terry Williamson, who highlights the far lower commitment to professional dissemination of thermal research results by the CSIRO’s building scientists in comparison to the Commonwealth Experimental Building Station. In reference to the CSIRO, “there is no evidence that the thermal research of the period had any direct effect on the design or construction of Australian houses”. In comparison, Glenn Murcutt, one of the most influential contemporary practitioners of bioclimatic architecture, regularly highlights the importance to his career of having to repeat a course in “Sunshine and Shade” while a student, a course certainly informed by the CEBS document “Sunshine and Shade in Australasia.” See corr. T.J. Cavanagh to L.P.D. O’Connor, February 2, 1944, A11677 S1943/65 Part 1, National Archives of Australia, Canberra; Grenfell Ruddock in Report (of meeting held at C.S.I. R., August 16, 1943, to consider proposals for a Building Research Station, A9816 1943/1009 Part 1, National Archives of Australia, Canberra; Philips, R.O. Sunshine and Shade in Australasia. Duplicated Document No.23. 1st ed. (Sydney: Commonwealth Experimental Building Station, 1948).

Draft Notes for discussion between Director-General and Minister of Post-War Reconstruction, September 1943, NAA: A9816, 1943/1009 Part 1, National Archives of Australia, Canberra.
Not everyone agreed that the tropical house was worthy of study, yet politically it still carried weight. Although Ruddock used the tropical house to illustrate procedure, in draft notes from August 1943 he mentioned that:

It is unlikely that it would be given priority over other more pressing housing problems. Just over 250,000 live in the tropics, while over 3 1/3m. live in capital cities where conditions of shortage are far worse than in the tropics. At the same time, it is recognised that an improved tropical house would assist to develop fertile tropical areas now almost uninhabited.  

Despite such reservations, the design of a low-cost tropical house was included as part of the Station’s remit when Chifley (as Minister for Post-War Reconstruction) and Joe Collins (Minister for the Interior) formally sought cabinet approval for funding a permanent Experimental Building Station in Ryde near Sydney in March 1944.  

The development of low-cost tropical housing also tested the boundaries of Commonwealth and State collaboration and gave further weight to locating the Station in Sydney. While the CHC was planning to develop tropical housing through the laboratory, the QTHC tried to advance its proposals by building test houses in the field. In January 1944, the QTHC invited members of the CHC to meet with them to advise on construction matters. It is worth recalling that O’Connor was both chairman of the CHC and a member of the QTHC. The meeting was occasioned by the Queensland Government’s recent approval of the construction of six experimental homes, realising one of the main points of action in the QTHC’s report discussed earlier. At the meeting the parties collaborated with ease, with both groups offering to assist each other. As chairman of the meeting, Cilento agreed to hand over to the CHC all data the QTHC had already gathered. In addition, Howard (CHC) submitted sketch plans for a sub-tropical house, which the QTHC agreed to use as one of a pair of experimental houses to be built in Townsville, Cairns and Cloncurry. The other experimental houses were to be designed by the Brisbane-based Austrian architect Karl Langer, who was

101 Grenfell Ruddock, draft memorandum for comment on Building Research Station: Notes on the scope of work and setup of the laboratories, August 1943, A9816 1943/1009 Part 1, National Archives of Australia, Canberra.

also in attendance. Howard was invited to develop his plans to construction stage and to attend monthly meetings of the QTHC.  

Yet there was always a certain amount of ambivalence within the CHC about collaboration with the QTHC. On one hand, the Commission praised their early work and were more than happy to receive their data. The Commission’s final report from August 1944 developed only limited recommendations for tropical Australia but advocated experimentation to find the most suitable house for any climate, enthusing about the QTHC:

In this regard, good work has already been done by the Queensland Tropical Housing Committee, which was set up in 1942 to investigate tropical housing, and is now considering the erection of experimental dwellings in selected towns.  

It seems likely that the Commission itself was divided about what role the QTHC would play, with Howard and O'Connor in favour of closer collaboration with the QTHC and executive officers such as Bunning and Ruddock preferring to leave preliminary work to the CSIR. Howard, particularly, seemed to value the CHC’s relationship with the QTHC, and the potential to develop new types of tropical housing. In July 1944 he defended the location of the Experimental Building Station in Sydney over Melbourne as necessary to facilitate close collaboration:

A great deal of work and investigation will be carried out by the Tropical Housing Committee, which has been established in Queensland. Should the station be established in Melbourne, co-operation with this committee will be prejudiced due to the increased distance from Queensland and the great difference in climatic conditions between Melbourne and Queensland.  

Howard placed the development of improved tropical housing as central to the work of the Experimental Building Station, but not everyone was as enthusiastic as Howard. Although Walter Bunning was impressed by the work the QTHC had already done, after meeting with its members in January 1944 he cautioned that the Experimental Building Station would need

103 Walter Bunning, Notes on the meeting between Queensland Tropical Housing Committee, members of the Commonwealth Housing Commission and the Department of Post-War Reconstruction, Brisbane, January 18, 1944, A9816 1943/1009 Part 1, National Archives of Australia, Canberra.

104 Commonwealth Housing Commission, Final Report, 89.

105 Howard, Experimental Building Station: Notes on the advantage of site for the Station being located in Sydney, July 8, 1944.
to carefully coordinate its work to avoid “overlapping research work on tropical housing”. Ruddock’s explanation (in August 1943) of how the Experimental Building Station would go about developing a low-cost tropical house made no mention of the QTHC at all, while naming a role for the CSIR. Although draft notes, prepared at a similar time, proposed that the Experimental Building Station would undertake weather tests on behalf of the QTHC, such references were soon dropped. As stewards of a Commonwealth agency, responsible for developing solutions at a national scale, prioritising the needs of a regional state committee seemed provincial at best to ambitious and worldly young officers like Ruddock and Bunning. In the end, firm decisions on how the CHC and QTHC would collaborate in the long-term were effectively postponed pending the appointment of a director of what was formally named the Commonwealth Experimental Building Station (CEBS). The inaugural director, David Isaacs, did not share Howard’s enthusiasm for locating the station in Sydney and in July 1944 proposed that it be built in Melbourne—a move his board members quickly prevented. By the end of December 1944, when the CEBS was asked by the CHC to examine the question of climate and small house design, no mention at all was made of engaging the QTHC to assist with the project. Although the QTHC proposals for experimental homes were still on the drawing board, they were about to be stalled for want of

106 Walter Bunning, Minute to Dr. Lloyd Ross, Re: Meeting between Queensland Tropical Housing Committee and Members of Housing Commission, January 24, 1944, A9816 1943/1009 Part 1, National Archives of Australia, Canberra.

107 It should be noted that the tropical house research project was still used as an example in March 1944 in the appendix of the Cabinet submission for funding approval of the Experimental Building Station. See Ruddock, Draft memorandum for comment on Building Research Station: Notes on the scope of work and setup of the laboratories, August 1943; also Hoy, Rivett, and Coombs, Appendix: Experimental Building Station, 14 March 1944.

108 Draft Notes for discussion between Director-General and Minister of Post-War Reconstruction, September 1943.


110 H.C. Coombs, Memorandum to the Director, Experimental Building Station, Re: Climatic Factors and Housing Standards, December 28, 1944, A9816 1943/1009 Part 3, National Archives of Australia, Canberra.
state funding. Instead the CEBS was to assume full responsibility to “examine the climatic factors which have a bearing on house design”, define climate zones and associated characteristics for a design, and establish “the form of housing to incorporate these characteristics”. In effect the CEBS was now completely responsible for defining the climatic features and form of buildings across the country.

Solar Planning and Climate in the CHC’s Final Report

Between October 1943 and March 1944, the CHC produced two interim reports. In the final report, published in August 1944, climate featured prominently, with particular emphasis placed on “solar planning”, a relatively new concept and method in Australia, but one that William Atkinson had first proposed in the United States in 1912. Buildings were to be spaced for solar access, setting acceptable density, site coverage and building heights. Housework and house layouts were to be organised according to the path of the sun (Figure 4.3). Data sheets included sun angle and shadow diagrams for all of the capital cities. This

111 At the John Thompson Lecture in October 1946, DHK Lee mentioned the development by the QTHC of designs for experimental houses but it is clear that by this point, the work of the committee had run its course. “Plans and working drawings were ready early in 1945. Nothing has since transpired and the committee has not been called together for twelve months. No reason has been given for the cessation of activities but “cost” has been suggested as a cause.” By this stage it is clear that the QTHC was moribund for though Lee was assisting the Experimental Building Station with field investigations this seems to have been in an individual capacity. Nor is there any evidence that the QTHC was asked to assist the Northern Australian Development Committee develop their report on the improvement of living conditions for tropical settlers. Instead Coombs, who also chaired the NADC, wrote directly to the Experimental Building Station for assistance. See Douglas H.K. Lee, "Human Climatology and Tropical Settlement: The John Thomson Lecture for 1946" (Brisbane: University of Queensland, 1947), 22. Also: J.W. Drysdale, "Climate and House Design: Summary of Investigations, 1945-1947," (Sydney: Commonwealth Experimental Building Station, 1947); corr. H.C. Coombs to D.V. Isaacs, September 25, 1946, A9816 1946/445, National Archives of Australia, Canberra.

112 Coombs, Memorandum to the Director, Experimental Building Station, Re: Climatic Factors and Housing Standards, December 28, 1944.

pointed to a form of solar regionalism, where latitude would determine building spacing and acceptable heights.

Figure 4.3. Activity diagrams showing ideal relationships between activities and aspect of rooms Source: Commonwealth Housing Commission, Final Report, 298.

Solar planning translated an American method, developed largely for New York’s canyon streets, to the bright skies of Australia. It prioritised sunlight as a source of illumination and downplayed any thermal consequences. An appendix in the Housing

\[\text{114 For shadow diagrams, see Atkinson, The Orientation of Buildings 19-21. The thermal effects of sunlight tended to be overlooked in Europe at this time and it was largely through the failure of a number of Le Corbusier’s buildings (Salvation Army Hostel, Marseilles Unité de Habitation) that there was some revision of approach. For a more detailed discussion of the 20th-century confusion, particularly within French modernism, between sunlight and solar radiation, see Bernard Barraqué, "Soleil-Lumière, Soleil-Chaleur: Deux Conceptions du Confort?," in Du luxe au confort, ed. Jean-Pierre Goubert (Paris: Belin, 1988); Daniel Siret and Amina Harzallah, "Architecture et contrôle de l’ensoleillement," presented at Congrès IBPSA France (La Réunion, 2006). Still there was some movement to consider the heat effects of sunlight such as by Henry Wright in the U.S.A. and the RIBA’s Joint Committee on the Orientation of Buildings. However the diagrams in the CHC’s Final Report have none of the detail or interest in accurately plotting sunpaths that were found in the RIBA report and Wright’s work afterwards. See Joint Committee on the Orientation of Buildings. The Orientation of Buildings: Being the Report with Appendices of the R.I.B.A. Joint Committee on the Orientation of Buildings,}\]
Commission’s final report included data sheets to apply solar planning principles in each capital city (fig. 4.4).

These gave sun angles for critical dates and times of the year. The sheets explained how to space buildings so that they were not over-shadowed between 9am and 3pm in winter. The limitations of the method were made obvious when applied to Darwin, for instance, and the authors conceded that Darwin required year-round shade—explaining, then, how to use sun angles to design for shade. Despite this, they still recommended that buildings in Darwin be spaced to avoid “winter” shadows, a surprising statement given the city’s tropical location. It is worth noting, in this context, Patrick Troy’s observation in 2009 that the report’s appendix on solar planning (along with Part V of report) was “the major teaching text in training a generation of Town Planners”.\(^{115}\) To an extent, the premise of regulating sun-light rather than sun-heat continues today in Australian planning regulations.\(^{116}\)


\(^{116}\) See for example Sydney Local Environmental Plan S.I. 2012 No. 628 Clause 6.17 which deals with sun access planes whose principal objective is to “ensure that buildings maximise sunlight to the public places set out in this clause”. In general links between the provision of sunlight and amenity are assumed throughout, even though skylights in many instances can provide sufficient illumination. The validation of sunlight also precludes the shading of public spaces by closely set buildings in summer time. Ralph Knowles has long argued for planning controls based on solar envelopes defined by a building lot’s right to solar radiation. See for example Ralph L. Knowles, Sun Rhythm Form (Cambridge, Mass.: MIT Press, 1981).
In the final report, tropical Australia was presented as a space apart from the rest of the country, worthy of mention only when questions of climate arose. The Commission thought that housing standards should be adapted to climate but noted that further research was required.\textsuperscript{117} In fact, while admitting that “the standards recommended apply mainly to

\textsuperscript{117} Commonwealth Housing Commission, Final Report (August 25, 1944), 89, 309.
temperate climates”, they expressed their doubts as to how best to set standards for the tropical north. While the report emphasised the importance of climatic conditions for defining minimum housing requirements, it thought it especially important for sub-tropical and tropical Australia. It even set out a possible method of defining these zones. Rather than emphasising regional specificity, as the Queensland Tropical Housing Committee’s 1943 report had recommended, for pragmatic reasons the Commission sought to divide Australia into two thermally determined zones. The zones were to be determined by whether or not the effective temperature was above a threshold of 75°F (24°C) for more than three months of the year. This threshold was set by the upper level of the comfort zone. Although the report used the neutral terms “zone A” and “zone B”, it effectively reproduced the binary distinction of tropical and temperate. For each zone, the report recommended a different type of house: “open” type houses of one room depth, which maximised cross ventilation, were required in the hotter “zone A”; while “compact” plan houses, where rooms were placed close together with little regard for cross ventilation, were best in temperate “zone B”. In temperate areas a combination of open and compact planning was possible, but the report did not recommend this for the tropics.

The decision to consider both heat index and thermal threshold suggests the influence of D.H.K. Lee. He had proposed—as noted at the beginning of this chapter—that the effective temperature was the fairest way to measure the effect of heat on Europeans. His doctoral thesis, applied research and publications during the war tried to show how this had applications for planning, clothing, the selection of settlers, the military and house design. Lee had already mapped Queensland to show how the effective temperature varied according to latitude and topography, indicating which parts he considered to be physiologically safe for European settlement and which parts required additional protective measures. This

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118 CHC, Final Report, 89.
119 CHC, Final Report, 309.
121 A full list of the range of Lee’s activities during the war may be found in the University of Queensland Fatigue Lab’s NHMRC wartime Open Research and Secret Research memoranda. See also Douglas H.K. Lee, "A Basis for the Study of Man's Reaction to Tropical Climates" (University of Sydney, 1940); Lee, "Physiological Principles in Hot Weather Housing with Especial Reference to Queensland," 15-22.
physiological risk assessment had sought to reinvigorate the White Australia project, and provide a rational basis for tropical settlement. The assessment was graded according to the severity of the average thermal conditions, starting at a general exposure to uncomfortable conditions and extending up to the point where physical work was considered dangerous. As applied by the CHC, however, Lee’s thermal regionalism, based on a range of thresholds, was jettisoned.

At first sight, dividing Australia into just two climatic zones appears to suggest that the Commission fell into the trap of assuming a uniform climate in each area—an even more climatically homogenised differentiation than the four zones (scorching, muggy, raw and keen) described by Griffith Taylor in 1916 and shown in Figure 2.4.122 In Queensland, this had been Lee’s longstanding bête noir—that outsiders assumed there to be the same climate throughout Queensland’s vast expanse when, in fact, there was widespread local variation. The Commission was not looking for complexity but for a straightforward method of relating basic housing requirements to climate that would “simplify the drawing up of charts or large-scale maps indicating requirements”.123 Representing local variations in climate was considered impractical since it rendered the pre-conditions of housing design overly complex. “To divide the country into zones determined by straight-out linear boundaries, such as lines of latitude appears wrong, as the climatic conditions vary considerably, even in places only twenty or thirty miles apart”.124 Instead they recommended that climatic factors such as temperature, humidity and rainfall be taken into account so that each zone had local subdivisions with more specific recommendations. Still, the maintenance of tropical and temperate distinctions, in the name of administrative efficiency, shows how the Commission continued to imagine tropical Australia as a vast, distinctive, climatically coherent area requiring separate forms of regulation.


123 CHC, Final Report, 309.

124 CHC, Final Report, 309.
CHC and QTHC Designs for Tropical Houses

The CHC and QTHC both acted as catalysts in the development of new designs of tropical housing. Charles Howard and Karl Langer attempted to use the emerging space standards of the CHC to develop novel proposals for housing. Today, Langer is the better-known designer and still a subject of academic interest, while we know little about Charles Howard.\textsuperscript{125} Certainly the design of tropical housing was of particular interest to Howard, and it would seem that the CHC’s tour of Queensland only enthused him further. He presented a sketch design for public comment in Mackay in July 1943 while touring northern Queensland with the CHC,\textsuperscript{126} showed sketch plans for tropical houses at the joint meeting of the CHC and QTHC in January 1944 and was asked by the QTHC to develop these further. Although never built, sketch plans for the QTHC experimental houses were developed in November 1944.


\textsuperscript{126} “Tropical Housing," Daily Mercury, July 17, 1943.
The plans (figs. 4.5, 4.6, 4.10) show an interest in testing the merits of low ceilings, high and low footings and the position, height and width of various combinations of louvre and window types. Yet in terms of planning, rooms are awkwardly placed together, with frequent instances of diagonal movement required to navigate between the narrow rooms. At the same time, there are traces of some of the plans in Cilento’s *White Man in the Tropics*. The low-level house for Townsville (Figure 4.5) with its square plan, central breezeway and allowance for cross ventilation, had many similarities with C.D. Lynch’s verandah-less house, which was described in the previous chapter. It would seem that for the QTHC, finally, there was a chance to put the ideas developed from the 1920s onwards into practice.

One of the plans for the QTHC experimental houses (fig. 4.6) also bears close resemblance to one for a subtropical house (fig. 4.7) published in the CHC’s *Final Report* in August 1944. It is likely, given that Howard was asked to develop plans for the QTHC while simultaneously serving on the CHC, that both plans reflect his input. Both are oriented north-east to south-west on their long axis; both have a wide upper floor terrace with strip

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window openings; both have their living rooms to the south west and kitchen to the north east on the ground plan.

Those for the CHC (figs. 4.7 and 4.8) have a simpler organisation, which avoids the convoluted circulation patterns of the QTHC plan. The distinctions between the sub-tropical and tropical houses developed by the CHC rest largely on the degree of openness of the planning, the height above the ground, the extent of the verandah and total floor space—some 58% greater in the case of the tropical house. The plans demonstrate that the CHC attempted to create more climatically specific house plans, with more consideration of shading and ventilation for tropical houses. The experimental homes showed only one or two bedrooms, and therefore at first sight appeared to accommodate up to four people. This would have entailed an allowance of 77-81 m$^2$ (833-874 sq. ft) based on the Commission’s allowances, yet none of the proposed designs was less than 108m$^2$ (1160 sq. ft). In part this was due to a difference in assumptions. In the tropical homes, sleep-outs replaced children’s bedrooms, whereas the CHC assumed they would be a surplus feature for large family homes, even in tropical conditions.

Figure 4.6. QTHC sketch plan of ‘two-storey’ type experimental house, Cairns N. Queensland, November 1944 Source: QSA 328603. Note the similarity in aspects of the plan to the CHC ‘tropical house’. 
This meant that the homes were really all intended to house households of six people, with some occupants expected to permanently use the sleep-out and others to sleep indoors. The dwellings in some cases were only slightly above the recommended amount for a six-person timber dwelling. In truth, even the Commission itself appeared ambivalent about its own space standards for tropical and subtropical areas or rural homes, illustrating its report with typical designs which, it noted, were not intended to indicate the allowable standard floor areas. It seemed that even for the Commission, at the outset, comfort would trump economy in these experimental homes. Curiously, too, it is the sub-tropical house by the CHC which is most similar in appearance and organisation to the QTHC’s experimental house, even though the experiment was to be set in Cairns—a city located well into the tropics at a latitude of 16.9°S, more than 1600 km north of Brisbane. This suggests that, for Howard, there were only slight design differences in houses for tropical and sub-tropical Australia—an attitude still widely held today in Queensland, but one that was not shared by Langer, as we shall see.
SUB-TROPICAL HOUSE.

The design is based on a prefabricated modular framework with a unit of 8 feet centre to centre. The main framework of the ground floor is concrete pier structure with infill of fibrous cement sheeted panels.

LEGEND

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Total Floor Area 908 sq ft.

Figure 4.7. Commonwealth Housing Commission sub-tropical house Source: Commonwealth Housing Commission Final Report, 291.
Figure 4.8. Commonwealth Housing Commission tropical house. Source: Commonwealth Housing Commission Final Report, 292.
Karl Langer’s Sub-Tropical Housing

Karl Langer’s work has, in recent years, received extensive treatment by Australian architectural historians, and it is not the aim of this chapter to delve deeply into this well-established discussion. He has been largely credited with both introducing and regionalising an American strand of modernism in Queensland and his pamphlet, *Sub-Tropical Housing*, remained a key point of reference for architects in south-east Queensland for over 20 years after its publication. Most scholars have drawn attention to the foregrounding of climatic issues in his architecture and his debt to Clarence Perry’s and Henry Wright’s concept of the neighbourhood unit. Most recently, Deborah van der Plaat has shown how Langer adopted the discourse on tropical fatigue among Europeans, as found in the writings of Cilento and Lee, using this as a reference for recovering the rationale for his architecture and urban design. Van der Plaat views Langer’s writing and designs in the pamphlet as the outcome of

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129 Wilson in particular presents him as “Usonian” in both his attitude to urban design and house planning and has attempted to draw parallels between Langer and his more famous compatriot, Rudolf Schindler. See Wilson, Andrew C. “Karl Langer’s Subtropical Housing: Greenbelt Communities and Usonian Variations,” In *Green Fields Brown Fields New Fields: 10th Urban History, Planning History Conference*, eds. David Nichols, Anna Hurlimann, Clare Mouat and Stephen Pascoe, ( Melbourne: University of Melbourne, 2010),626-30.


discussions within the QTHC about how careful planning and domestic equipment would help overcome neurasthenia and fatigue and improve the welfare and efficiency of white Europeans, a claim this thesis also supports.\footnote{van der Plaat, “Architecture of sun and soil,” 1125-6.} 

Figure 4.9  Sub-tropical House, U-shaped Plan. \textit{Source:} Langer, \textit{Sub-tropical Housing}, Plate 2.
She notes how, in Langer’s house plans,

the fatigued housewife, previously exposed to unreasonable levels of labour—a condition that her limited capacity to acclimatise to a tropical or subtropical climate—is now replaced, through effective planning and design, by one that is relaxed, comfortable and in control both of her household and the climate she lives in.  

As seen in figure 4.9, many indoor services, such as fireplaces, showers and cookers, are duplicated for outdoor living. Overhangs are sized to control summer sun and admit winter sun. Patios are provided “for outdoor living and social entertainment”. Kitchens are located close to trade entrances with hatches to connect to dining areas. Daytime and night-time living spaces are grouped together and carefully separated.

Largely overlooked by historians, however, is the specificity of the “sub-tropical” in Langer’s title, and what this means for both his writing and designs. Sub-tropical had come to be the term used for the southern coastal part of Queensland, extending from approximately just south of Mackay to the north of New South Wales. It implied both a heating and a cooling season and, in all of Langer’s designs, a fireplace features prominently. Although he characterises a sub-tropical climate “by the length and severity of its summer”, he still accommodated seasonal living practices, discussing not only how to design to reduce heat gain and “the fatigue of the housewife” but also to respond to winter climate:

In our endeavour to keep our houses cool during the hot summer, we should not forget to consider the winter months with their cold westerly winds. As facilities for heating rooms are somewhat inadequate, it should be arranged that the low winter sun can penetrate and bathe the living room in sunshine.

Langer’s house plans demonstrated his concern for winter and summer climatic design as well as his agreement with medical assumptions about the role of climate in causing fatigue and nervousness. Langer certainly incorporated many of the suggestions in the QTHC’s 1943 report into Sub-Tropical Housing, where fatigue was largely framed as a problem involved with manual work in excessively hot conditions, but he also revelled in the

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hybridity of the sub-tropical climate. Van der Plaat’s assessment highlights Langer’s use of climatic and spatial design to pacify the harried housewife. But the tactics he adopted—the careful layout of kitchens, service entrances, clear separation of living and sleeping spaces, single storey dwellings—had as much in common with American debates about the future of post-war housing as they did with those concerning tropical design.

Publications like the *Architectural Forum* challenged architects to rethink the future of the American suburban house, adopting the position that “improved living conditions do not stop with equipment” but, rather, come through better spatial planning.136 Between 1942 and 1944, the magazine ran a series of issues addressing “The House of 194X” and “The Neighborhood of 194X,” which featured a range of speculative proposals imagining the future of post-war living.137 The article “Planning the Post-War House II” (1944) reads as a primer in post-war design. Kitchens were to be planned as “work centers” combining cooking, laundry, heating, storage and eating areas. Cupboards were to be carefully positioned so that windows could be placed above sinks, thereby affording views outside. Basements were out, since the introduction of washing machines rendered a dedicated laundry space obsolete. Houses needed a greater amount and variety of built-in storage. The bathroom was to be treated as a special form of such storage. Alongside this was the promotion of solar design—at once a proof that modern architecture could be economical and a panacea for the war-time anxiety Americans faced about resources.138

Langer’s decision to do away with traditional high-stumps was controversial and bore more than a passing resemblance to the American removal of the basement. Many of the functions of the basement—laundry, surplus storage and play-space—had historically been housed in the undercroft of the high-stumped Queenslander. When housing authorities started to consider the adoption of flat, concrete-slab foundations, thereby doing away with costly raised stumps, one of the main objections was the loss of laundry space. A journalist captured the intensity of the debate:

136 “Planning the Post-War House II,” *Architectural Forum* 80, no.2 (1944), 70.


The debate now troubling the air goes a bit further than freezers and trimmings, however. It concerns single and double storeys, high or low stumps, big kitchens or little kitchens, and bathrooms upstairs, to be or not to be. Architects are throwing verbal bricks at each other, and the high stumpers versus the low stumpers are as busy running up and down as the monkeys at Taronga Park.  

Langer came closest to bridging the gap between economics, climatic design and modernism. His chief contribution to lowering the cost of houses was to allow them to be built in stages and to build them on level ground. This questioning of the raison d’etre of the traditional Queensland dwelling provoked a mixed response, with architects rejecting the suitability of Langer’s houses for hilly Brisbane and politicians refuting the problems with the high-set houses, advocating their advantages for future adaptability, play and clothes drying.

Figure 4.10. QTHC sketch plan of ‘line’ type experimental house, Cairns, N. Queensland, November 1944 Source: QSA 328608.

The extent to which Langer’s plans influenced the QTHC and CHC in turn is a matter of speculation. His plans were dated 1943. According to Andrew Wilson’s evidence, Langer

139 "Future Homes for the People." Maryborough Chronicle, Wide Bay and Burnett Advertiser 1 July 1944, 5.
appears to have first prepared the plans for the Housing Commission sometime before September 17, 1943. He wrote to Prof. A.S. Hook on that date, telling him that “I got the idea of sending seven standard plans for houses designed for the Queensland Climate to the Housing Commission.” Thus the letter was written around the time that the Commonwealth Housing Commission was debating how to develop a tropical house in the context of discussions about the establishment of an Experimental Building Station (noted above). Yet neither of the published designs for a tropical or sub-tropical house in the CHC final report, shown earlier, are especially faithful to Langer's principles—the only similarity (Figure 4.10) being that some of the QTHC plans were also low-lying, which is a controversial enough measure to register as potential evidence of the Austrian’s influence. As van der Plaat has claimed, though, it seems likely that Langer was aware of the QTHC report (which was in development between February and May 1943) when he produced his designs. Cummings (of the QTHC) taught with Langer at UQ and Langer, in turn, presented sketch plans alongside Howard's for “sub-tropical housing” to the joint meeting of the QTHC, CHC and Post-War Reconstruction held in Brisbane on January 16, 1944. Therefore, at the very least, such plans must have been instrumental in his being noticed by the QTHC and invited, in turn, to develop schemes for experimental houses.

A Material Residue of Medical and Architectural Collaboration

The remains of this collaboration between the CHC and QTHC are a series of plans and booklets for experimental housing in tropical and sub-tropical Australia. They point to a brief moment—a second such instance—in which architecture and tropical medicine influenced each other’s thought and practice. Physiologists like Lee collaborated with architects and

140 Wilson, “Karl Langer’s Subtropical housing,” 129-130.

141 As quoted by Wilson, corr. Langer, Karl, “Letter to A.S. Hook,” in Karl Langer Collection (St. Lucia, Qld.; Fryer Library, University of Queensland, 1943).


143 Bunning. Notes on the meeting between Queensland Tropical Housing Commission and the Department of Post-War Reconstruction (Brisbane, January 18, 1944), A9816 1943/1009 Part 1, National Archives of Australia, Canberra.
engineers for the first time; his paper “Physiological Principles in Tropical Housing, with Especial Reference to Queensland” (1944) was the first occasion on which he applied his work on hot-climate physiology to the field of tropical housing. In the paper, he expressed his admiration for Langer,144 drawing his readers’ attention to Sub-Tropical Housing. Both published by the University of Queensland in 1944, this pair of documents track two faces of a discourse on tropical housing at a crucial junction, informed by an intense period of post-war planning in a time of conflict. On one side stands Lee, recognising the importance of applying science to environmental considerations at the domestic scale; on the other side is Langer who, in taking up the lessons of the tropical house for the subtropical setting, laid the foundations of an international modernism in Queensland.

Conclusion

In contrast to the situation in the capital cities, where public opinion was mobilised through ideal home exhibitions and demonstration buildings, for example the Victoria Housing Commission’s Beaufort House, no exhibitions were held, nor demonstration homes built, to foster an architectural sensibility for the tropics in the tropics.145 The CEBS test homes that were built throughout Australia between 1945 and 1947 to test the thermal performance of various construction systems came closest to a set of demonstration homes. These, however, were only made public through later reports, and knowledge of them was largely confined to the technical community of architects and engineers.146

Tropical architecture was envisaged differently in the State and federal investigations that were formed as part of post-war planning. For State investigators, it offered the chance to

144 Lee, “Physiological Principles in Hot Weather Housing with Especial Reference to Queensland.” 15.


realise the long-standing dream of a physiologically perfect house—a form of climatic armour—that provided the tools for permanent tropical settlement that had been sought since the 19th century. Designs that were considered radical in the 1920s, therefore, were resurrected, pared-back and modernised for want of materials and labour. Such innovation in design that did occur was directed towards the sub-tropical house rather than the tropical house, and the realisation that many of the American ideals about post-war planning could pertain to suburban Brisbane generated a new approach that brought modernism to sub-tropical Queensland—a hot modernism, but not overly so. At the same time, the rhetoric about tropical fatigue and the broader medical considerations around domestic life in the tropics also served its purpose, being invoked in the subtropics to create anxieties about white woman’s place in hot climes as a means of justifying the low-lying suburban home. In all of this, the tropical house was at once central and peripheral—central to the image of Queensland’s sub-tropical embrace of modernism, but not a site of sustained experimentation.

Federal investigations had located the tropical house as a common problem through which to test inter-departmental collaboration—a means to break down a design problem into its constituent parts (physiological, material and compositional), package each stage of an investigation and despatch it to the relevant agency. Yet it was also a focus of efforts to localise national standards for houses, particularly prefabricated ones. This was not really about the improvement of comfort but about finding more efficient ways of building houses in Australia in general—houses which, having been tested against the most extreme conditions the country could present, would be no less comfortable than those that were already available.

Still, the belief that the tropics were a space apart persisted in federal, State and institutional discourses, requiring more indulgent space standards and greater attention to the needs of women. The binary distinction of tropical and temperate continued to structure discussions about housing well into the post-war era. A physiological world view that sought to manage public discord by controlling thermal conditions found its way into architecture as well. This took the form of comfort standards that would be used to make prefabricated buildings appear more palatable to a sceptical public. Yet comfort, too, could be mobilised as a reward for wartime sacrifice—with domestic air conditioning suggested as feasible for tropical homes—much to the consternation of the Queensland economist Colin Clark, who
saw the potential for wasted resources on a large scale. While the problems of “whiteness” in Australia, especially in the tropics, held little of the appeal for researchers that they had done at the turn of the century, published reports on tropical design in Australia continued to qualify its audience as white well into the 1950s.

The investigations by Experimental Building Stations into climate and small house design from 1945 to 1947 sought an immediate post-war confirmation of the work done during the war. They produced a set of technical documents that showed the effect of climate on different forms of construction and the effect of building construction on occupant comfort. These formed the basis of a growing scientific literature that was driven by building science (rather than medicine and physiology) and which sought to educate the architectural profession, the results of which are only now being appreciated. Yet in the design of homes during the 1940s and immediately after the war, there was no acknowledgement by architects in Queensland of the community-based work during the 1920s to develop tropical homes, or of the scientific studies that had had both drawn from and informed those pioneering efforts. This work had quickly fallen from view as the profession established a new starting point for its exploration of the factors shaping design in the Australian north. The preoccupations with climate and settled white domesticity were, of course, all there in the writing and planning of architects like Karl Langer. Yet the perception of this work as arriving as a fully formed product of Langer’s own considerable abilities is quite incorrect. Missing from this image are the sustained and awkward, but necessary, subsequent attempts by the QTHC, CHC and (later) CEBS to balance architectural propositions with political and economic considerations well beyond the traditional scope of architecture and to advance, therefore, a discussion around architecture’s role in the project of tropical settlement that was many decades in the making by the end of the Second World War. For this they turned to the sciences of economy, materials, demography and (certainly) physiology.

It may seem easy to dismiss the awkward attempts to fuse architecture with scientific methods of problem solving around the tropical house in the Australian north. This work, though, both laid the groundwork and opened the door on interdisciplinary collaboration on problems that architecture regarded as its own. In this sense, this long path led to a new post-war starting point: an earnest attempt to scientise architecture. Yet it is telling that science and (indeed) medicine were deemed necessary to solve architectural problems only in moments of crisis—be they racial or material in nature. It reveals a latent fragility on
architecture’s part in relation to external shocks and crises. The evolution of thought around the tropical house in northern Australia shows how architecture’s consistent vulnerability to external conditions and the demands of other fields of knowledge has presented a series of opportunities for other disciplines to reshape architecture itself. In the tentative resolution of the problem of the tropical house and of design for the “Australian climate”, this vulnerability remains latent for architecture, even in its most apparently rational, scientific form.
Conclusion

The tropics have long been a place where environmental ideas about architecture were tested, reworked and reimagined. From screening against insects to providing the conditions for rest, architecture has been conceived as a form of armour against conditions that were considered a threat to wellbeing. Many of these threats were real, but others, like ‘neurasthenia’ and ‘miasma’ proved illusory. Yet just which aspects of the tropical environment were considered threatening and where exactly the tropics of the imagination lay was something that shifted with new theories of disease, new instruments to measure temperature and new social conditions.

This dissertation has consistently conceived of the tropics as a thermal frontier in Australia’s architectural and medical imagination. Further developing Frederick Jackson Turner’s concept of the moving frontier, it has used the term ‘frontier’ to understand how experts valued the taming of the wilderness as both a scientific and historical process to make it safe for European habitation. Turner’s frontier thesis has its limitations, but historians acknowledge it as a key trope used to explain ‘the taming of the West’. As the dissertation has shown, it resonates with the attitudes and writings of doctors like Raphael Cilento and J.S.C. Elkington. As explained in chapter two and three, Cilento and Elkington believed that Australians of European heritage could tame the tropics and maintain a high standard of life provided that certain customs were shed and more climatically appropriate ones adopted. These adaptations were presumed not to come from Australia’s indigenous culture, but from traditions native to the Malay peninsula or India. What appears at first an irony—that those most against Asian immigration were also some of the main promoters of Asian building traditions—can be better understood when we reconsider the expectations about cultural and democratic renewal that came with Turner’s frontier thesis.

For Turner, the moving frontier was the “meeting point between savagery and civilization”. It was a place for Europeans to cast off their traditions and adopt practices more suited to their environment. In this understanding, traditions evolved through trade and exchange with the Native American population. However, this population was also one that Turner and his followers considered a threat to European security, requiring management and subjugation. Through this creation of a common enemy at the frontier, Turner argued that the bonds of community and identity were formed among European settlers. In Australia’s case, the frontier wars between settlers and Aboriginal Australians had largely passed by 1901—the common enemy was conceived differently. By the time of the White Australia policy, it was considered to be Asian, a catch all term for Chinese and Japanese diasporas and states. Medical experts such as Cilento or Elkington were therefore more than happy to suggest the Malay house as ideal for tropical Australia. They disparaged the ongoing use of temperate building traditions in tropical Australia as ignorant and conservative, all the while emphasising the tropical (male) settler as a patriotic and hardy individual, necessary to keep the supposed threat of Asian invasion at bay.

An important aspect of this story, bearing on architecture’s agency in northern Australian settlement, is how little success doctors and architects had in getting settlers to readily adopt new forms of construction and new ways of organising buildings during the first half of the twentieth century. Unlike Panama, where commerce, politics, medicine and logistics came together under near military rule, doctors and architects in northern Queensland struggled to put their more radical ideas into action. Even when the threat of Asian invasion did come to pass (with the Japanese bombing of Darwin and Townsville), Lee, Cilento and architects such as Charles Howard saw their work for the Queensland Tropical Housing committee stalled. Many of the problems settlers faced were economic and social rather than simply climatic. Women were isolated and, therefore, stressed—receiving little outside help and often, in the case of soldier settlements, supporting a husband suffering what we would now term post-traumatic stress disorder. In that sense, the most illuminating example of this thesis has been the holiday homes for the QCWA, in which new ideas about housing were tested and reduced to essentials, reflecting the limited funds available to build

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them. It might be tempting to view the QCWA huts as an example of Turner’s frontier solidarity in action, but some caution is required. For while the huts certainly allowed architects like C.D. Lynch to put some of his ideas about verandah-less tropical housing into practice, the CWA’s scheme of holiday homes stretched along the whole of the east coast of Australia from the state of Victoria all the way to the tip of northern Queensland. This was not only a proposition for the frontier. Still, the QWCA huts point to early attempts by architects to provide economical solutions to life in the tropics and are useful for understanding how the tropical climate could be seen as both hazard and opportunity at the same time. They might well be placed in a broader history of tropical architecture beyond Australia, of attempts made to ameliorate the conditions of life for poor residents (whether settler, migrant or indigenous) through the provision of that most modern antidote to work, the holiday.

This thesis has argued that, for architecture in the tropics, the thermal frontier was largely constructed as a technical problem concerning the thermal limits of European civilization. This was a civilization defined not in terms of its ability to produce great works of art, new scientific knowledge or its political and religious traditions, but almost exclusively in terms of its capacity to undertake work. For in the end, the thermal frontier as a concept helps us understand how thermal control was expected to make a people and a territory more or less productive. This definition continues to hold sway when discussing the significance of thermal environments. The assumed close correlation between thermal culture and work culture is a premise still regularly invoked by engineers, architects and thermal comfort researchers to justify improved systems of thermal control and the economic significance of research findings. Yet work’s opposite, leisure, was also assumed to be enhanced in certain thermal environments, more for its difference from an assumed norm, its ability to offer an environmental change, than any particular range of temperature.

The fourth chapter took a detailed look at how the tropical house shifted from the domain of medicine to the domain of architecture. The legacy of this, we have argued, institutionalised the study of heat as the primary environmental design problem in Australia. Even today, a building by Glenn Murcutt or Sean Godsell is celebrated both in Australia and

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abroad for how it shades and ventilates the interior and its surroundings rather than for how it performs in winter. The global image of Australian architecture is still the one-off house, a tent in metal and glass, situated in supposedly virgin territory, with all roads and access-ways hidden from view. That most take this to still be evidence of an innately Australian environmental ethos can be understood when we look back to how the frontier was framed as a thermal problem for architecture. Architecture taps into this mythology, but such buildings are mostly for leisure rather than poor farmers as they were at the turn of the century.

The thesis has emphasised too, the importance of paying attention to the socio-political formation of a site being studied. In particular, with northern Queensland, it has shown that while much of the discussion about tropical formed part of a global discourse on health, climate and architecture, the emphasis on servant-less living and the welfare of European women stood in contrast to most other locations across the world. The study of settler-colonial tropical and sub-tropical architecture is still in its infancy, with only a few scholars paying much attention to the particularities of this colonial condition. These pages have, therefore, endeavoured to highlight the role of women in shaping the discourse on the tropical house and some of the institutions in the tropics, something that surely occurred in other tropical locations, but on which there is scant scholarship. Further work also needs to be done to examine indigenous perspectives of settler-colonial architecture, in particular the settler denial of the indigenous presence and how this affected the siting of towns, the valuation of indigenous technologies and architecture and indigenous resistance to such perspectives. In that regard, it might be useful to expand the concept of the thermal frontier to look at what have been considered to be extreme thermal environments in the past and into the present. This could allow us to place the history of settler colonialism in polar

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environments into conversation with settler colonialism in tropical environments. It seems likely that design of mining communities that developed in northern Canada, Alaska and in Sami Finland between the 1950s and today could readily be productively compared to those throughout northern Australia or South Africa; likewise many of the building research stations established at the end of the second world war were in settler colonial countries and much concerned with problems of thermal design. In effect, this would help place an architecture of heat and coolth in the frame of settler-colonialism.

The writing of north Queensland’s architectural history is still a thing of scraps and fragments that has never received the same attention as the built environment in Australia’s southern capitals. Too often, as noted, state throughout this dissertation, capital and region are assumed to be the same in Queensland. This thesis has sought to pull this assumption apart by showing that there were separate architectural cultures in Brisbane and in northern Queensland, and that the regular attempts and resistances to using climate to develop more localised solutions to housing. Within Australia, Queensland’s architectural history has existed as a counterpoint to the dominance of stylistic explanations of architectural culture in Sydney and Melbourne. It has often been framed as a tropical other, to temperate culture in Australia. Yet it too has tended to be dominated by examples found in Brisbane and its hinterland. A recent exhibition on ‘Hot Modernism’ that purported to examine architectural culture in all of Queensland contained a visual essay on ‘Climate and Regionalism’. However the curators selected only one case study out of seventeen buildings in north Queensland. This thesis unearths a number of case studies where north Queensland was of considerable architectural interest.

Piecing together the story of the north Queensland house during much of the white Australia period, required an attention to sources little considered by architectural historians.


Medical textbooks and journals, pamphlets for holiday homes and government inquiries on dangerous trades all facilitated the discovery of new projects of significance and a deeper sense of the context within which tropical architecture was formed. Most of this discussion occurred outside of the professional journals and it is significant that many of the projects were regularly reproduced within medical publications but not, on the other hand, in architectural ones. Still, as a largely archival project, further insight might have been gained through site visits, interviews and even thermal simulation to assess official claims against the physical presence of the buildings themselves.

While north Queensland may seem peripheral to current and past discussions about architecture in Australia, during the period of this study, the region and its buildings was of considerable interest to the medical profession. It countered environmental deterministic explanations by geographers such as Ellsworth Huntington or even Patrick Manson in medicine, that the tropics were no place for Europeans. The studies undertaken by DHK Lee at the end of the war into Queensland tropical architecture, would re-emerge as a publication on the *Physiological Objectives in Hot Weather Housing*, a key text on hot weather housing design in the United States.7

The brief, state-sponsored interest in tropical housing in Queensland during the Second World War, quickly gave way to a relative apathy about housing in northern Queensland. Instead, after the war, speculation about tropical housing concentrated largely on the requirements of government employees in Darwin and, during the 1960s and 1970s, the planning of mining townships in the interior of the continent.8 If anything, today it is the legacy of Darwin’s inter-war housing by the Commonwealth Department of Works, particularly the work of Beni Carr Burnett, which has acted as the key reference point for tropical architecture in Australia. This has not come about by accident but through the ongoing promotion of Burnett’s work through the writings and buildings of Phil Harris and


Adrian Welke of Troppo Architects from the 1980s and the research of David Bridgman during the late 1990s and early 2000s.9

Yet that does not mean that the discourse on the north Queensland house failed to leave its mark on Australian architecture, the general public or architectural historians. It was just that the specificity of north Queensland was often lost on most writers as the regional characteristics of most buildings was associated with the state as a whole or, more broadly, all of tropical Australia. Writers continued to emphasise Australian tropical architecture as an exemplary case study of European climatic adaptation well into the 1970s. Balwant Saini invoked the spirit of Cilento when he wrote that:

As a field for the study of tropical architecture, Australia presents a unique opportunity to examine how people of European origin have met the challenge of living and working in what is largely a tropical environment. It is a challenge which demands new techniques and expertise of a society accustomed to cold winters and reliable rainfall.10

Indeed ‘the challenge’ of the climate remains an ongoing theme in any discussion of architecture in Far North Queensland with each generation of researchers finding new ways to historicise the bungalow in relation to contemporary anxieties about the environment. Ray Sumner, writing about the bungalow in the 1970s, was interested in its habitability, a common theme with spacecraft design, whose influence she acknowledged in her research design. A resurgent interest in houses in northern Queensland came about during the 1980s disappearance and the increased preferences of buyers for older Queensland houses due to their more generous space standards.11 Today faced with anxieties about climate change, and population pressure the north Queensland house serves to remind us that the value we place on the environment has shifted faster than the climate itself. We still seem to imagine that through environmental design, architecture can help maintain today’s society well into the future. Instead, the history of the north Queensland house shows that though we can find

inspiration for older technologies and forms of environmental control, the meanings we attach to them change just as the society itself does.

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