– ARTICLE –

'NEW ZEALAND IS NO MORE':
BOTANY AND MOBILITY IN THE CAREER OF LEONARD COCKAYNE

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ABSTRACT

An emerging 'new mobilities paradigm' in the social sciences has begun to focus critical attention on the meaningfulness of mobility rather than the simple geometries of movement. This paper draws on recent work in the mobilities field to explore the entangled mobilities of botanical practice in early twentieth century New Zealand as seen through the career of Leonard Cockayne. In doing this the paper argues that recognising the multiple dimensions of mobility in Cockayne's botanical work offers a way of helping develop our understanding of the 'lives told' of early twentieth scientific practice and of placing one of those lives within its broader historical context. The ensuing process is part of the ongoing and necessary effort to view science as a situated, embodied and very human set of practices, which simultaneously deepens our understanding of the historical and situated genealogies of mobility.

INTRODUCTION

An emerging 'new mobilities paradigm' in the social sciences has begun to draw critical attention to the meaningfulness and cultural embeddedness of mobility rather than the simple geometries of movement (Cresswell, 2006; Sheller & Urry, 2006). Work framed by this emerging concern has been diverse in its interest in the various means, places and experiences of mobility (for overviews see Blunt, 2007; Cresswell & Merriman, 2008; Urry, 2007). A focus of this emerging body of work has been an attention to the entanglement of movement, representation and practice situated within specific historical and geographical trajectories. Framed by this work the paper explores the entangled mobilities of botanical practice in early twentieth century New Zealand as they are embodied in the career of Dr Leonard Cockayne (1855–1934) CMG, FRS, Hon. DSc (NZ), PhD, FLS, FNZI. The purpose of approaching mobilities through a specific attention to Leonard Cockayne is twofold. First,

Cresswell (2010) argues that much of the mobilities research has been characterised by a presentism that has implicitly contrasted a mobile now with a sedentary past. Consequently an important feature in the development of nuanced understandings of the entanglements of mobility lies in the necessary appreciation of old mobilities, and the development of an understanding of the extent to which, 'elements of the past exist in the present just as elements of the future surround us' (Cresswell, 2010: 29). An attention to the historical articulation of mobility therefore provides a necessary corollary to a concern with present. This concern with the historical dimensions of mobility also dovetails with a developing understanding of science (and scientists) as a situated and embodied activity rather than a placeless and transcendent one (Shapin, 2008, 2010). Second, and more specifically, the historiography of science in New Zealand (and elsewhere) has been largely dominated by biographical writing characterised by a pious concern with the 'lives lived' of scientists. Approached through Cockayne's career, this paper, then, is an attempt to present a form of scientific biography that is concerned with examining the complex facets of a 'life told' and in doing so also considering the importance of the production and orchestration of mobility in the fashioning of a scientific life that was simultaneously national and international, deferential and assertive, mobile and immobile. Cockayne's botanical career in this sense provides a strategic, albeit not unique, aperture with which we can begin to discern the complex, embedded entanglements of mobility that have characterised the production of scientific knowledge in New Zealand.

The paper begins by discussing the different dimensions of mobility that provide the conceptual basis for the paper. Here the paper links these facets to the concern with movement and circulation that have also been a feature of contemporary histories of science. The paper then provides a brief sketch of Leonard Cockayne's career, which places him within the wider context and hierarchies of early twentieth century New Zealand science. The final section of the paper focuses on the rhythm of Cockayne's botanical movement and interprets that movement in the context of Cockayne's own reflections on the nature of botanical fieldwork and the gathering forces of environmental transformation.

DIMENSIONS OF MOBILITY

In his recent book *Mobility*, Adey (2010) argues both for the ubiquity of mobility in constituting the quotidian fabric of contemporary life and for a growing awareness of this constitutive power. In what Urry (2007) has termed the 'mobile turn' scholars from a range of disciplines have been increasingly trying

to understand the complex assemblages and lives constituted through changes in the organisation, politics and experience of mobility. Within these debates, Urry (2007) has forcefully sought to reimagine the social as something produced by and shot through with complex mobilities. In this vision every element of the social exists in some relation to mobility, and indeed on this point Kaufmann (2002) advocates for eliminating the very notion of society in favour of an approach based on movement. Given this impetus how then can we go about understanding the constitutive power of mobility? Here Law (1994) provides us with a starting point insofar as he suggests that in the first instance mobility, and its obverse immobility, is the result of ongoing work rather than markers of position. Thus, in this formulation, conditions of mobility and immobility are the outcome of contingent relationships rather than the inherent attributes of objects and people. These relations are complex but involve the use and production of space, the mooring of mobilities to complex relations of immobility, and the orchestration of intersecting trajectories and synchronicities (Adey, 2010).

As we move our paths are shaped by the spaces that we move through, but, as Massey (2005) argues, at the same time as we move through space we also alter space both for ourselves and for those people and objects around us. The analogy here is with a spider's web as its strands deform and snap according to movement across it. Space in this context is not an isomorphic plane upon which movement and connection is possible in all directions. Instead our mobilities are channelled along specific paths and across those striations that Deleuze (1992) identifies as an integral feature of modern 'societies of control'. Mobility along these routes is unevenly experienced as systems of control variously celebrate and enhance the mobility of some people and things while simultaneously snagging and halting other people and things (Adey, 2003; Henry, 2008). Moreover, spatial relations, as the topological writing of Law and Mol (2001) has argued, are not necessarily characterised by a classic Euclidean geometry. Instead relationships of connection are only loosely defined by conditions of propinquity and instead are more often marked by the baroque intersection of the near and the far, the large and the small (Law, 2004). In these cases the relationships that frame the intersection of mobility and space are characterised by paths that while unevenly imagined, practised and experienced, do nonetheless shape the mobility of everything and everyone. Part of our work, then, in unpicking present and past mobilities is to uncover and contextualise the specific power relations, connections and hierarchies that shape the paths that mobilities are enacted along.

Mobility exists alongside conditions of immobility. This relationship is not a

residual one to be eliminated by the further extension of more perfect conditions of mobility, nor is immobility simply an absence of physical movement. Rather, the relationship is a dependent one insofar as complex mobilities are required to be embedded in relations of immobility (Adey, 2010). Urry (2007: 21) uses the term 'mooring' to denote those conditions of solidity and fixity that 'enable, produce and presuppose extensive new mobilities' and in an illustration of this point Agar (2003) highlights the role of fixtures such as physically grounded infrastructural networks in enabling mobile activities. As work on the history of science tells us, however, the necessity of moorings extends well beyond the physical fixity famously described by Latour (1987) in his analysis of the ship as a network of relations. Shapin's (1994) classic discussion of the production of scientific truth in the seventeenth century demonstrates that truth was a social relation made possible by the fixing of social identities around the perceptual acuity and credibility of gentlemen *vis-à-vis* other scientific agents. This point is developed by Heffernan (2001) who argues that when confronted by the dilemma of trustworthiness caused by the narratives of exploration that started to prove so popular in nineteenth century Europe, the putative solidity of gentlemanly identities provided the social and epistemological mooring that enabled the circulation of the credible narratives of the seemingly incredible. The key point here is that relationships of material and social immobility are integral parts of defining and enabling mobility. Yet immobility, like mobility, is not an ontological attribute of a material thing or person. Rather it is a relationship that is the outcome of ongoing work, framed by complex power geometries.

Our mobility involves the orchestration of the trajectories of the people and objects around us. On one hand the pervasive synchronicity that characterises our mobilities suggests that it is an integral part of our experiences and practices of mobility (Adey, 2010). However, the successful performance of synchronicity can hide the complex trajectories of people and objects that have brought them into alignment. This can be seen in the extent to which the orchestration of synchronicity is very quickly resolved into the conditions of normalcy through which we lead our everyday lives, conditions of normalcy whose fabrication is exposed when the accomplishment of synchronicity breaks down. For Lefebvre (2004), these ruptures in the rhythm of normality provide a glimpse into the intricate work and world that lies hidden under the surface and beyond the horizon of our social lives.

Concerns with synchronicity, the effort to create it and its fragility, can be seen underpinning tensions around the production and circulation of scientific knowledge. For Latour (1987), much of the epistemic power of science lies in

an ability to enable action at distance and at the heart of this power was the orchestration of people, objects and knowledge into relatively durable, yet mobile, networks. Yet, as scholars have increasingly come to understand, beneath the seemingly effortless diffusion of universally transcendent knowledge, there exists complex, ongoing work designed to simultaneously fix epistemic authority and enable the circulation of knowledge (Gieryn, 1999; Shapin, 2010). In this context the necessary circulation of knowledge created in one place 'is not simply the story of universal truths being manifest in particular settings. It also has to do with managing the transfer from one venue to another' (Livingstone, 2003:142). Such work involves not only the organisation of scientists, their craftwork, instruments and data into relatively durable, mobile assemblages, but it also includes the creation and disciplining of dispersed scientific communities (Livingstone, 2003). These communities have been and continue to be thoroughly entangled in the politics of place that powerfully shape the spaces of scientific work, the routes and rhythms of scientific workers and the interpretation and credibility of mobile scientific truths (Livingstone, 2005).

Relations of mobility and immobility are not given. Rather they are the outcome of ongoing fashioning that involves the intricate production of space, fixity and synchronicity. The accomplishment of this work is only ever temporary, and its contours are unevenly practiced and experienced by individuals and groups across space and time. These facets are assembled into historically contingent, albeit often remarkably durable constellations of mobility which are not confined to the overt activities, technologies and spaces of movement but are embedded in the very constitution of social life (Cresswell, 2010). Questions of mobility lie at the heart of scientific endeavour, and specific constellations of mobility have enframed and guided scientific workers such as Leonard Cockayne. But as we shall see these relationships were not simply imposed but instead they were often self-consciously mobilised and celebrated in the process of fashioning careers. In the pages that follow we explore the relationships of mobility that enframed Cockayne's career and the work he performed to bend these relationships into new forms and paths. Work, as we shall see, that involved a concern with the production of spaces such as his gardens and field sites, the fashioning of a suitably durable scientific identity and orchestration of myriad flows of plants, information and people.

COCKAYNE AND SCIENCE IN NEW ZEALAND

Lambert and Lester (2006:21) maintain that when thinking about the trajectories of individuals the notion of a career is a suggestive one to use because it is a term, 'that captures a sense of volition, agency and self-advancement, but

also accident, chance encounter and the impact of factors beyond the control of the individual'. Drawing on both this sense of the purposeful and the contingent this section briefly sketches the scientific career of Leonard Cockayne and places him within the wider context of New Zealand and international botany. We will see Cockayne's sustained efforts within the hierarchical and dispersed community of international botany to fashion and fix a scientific subjectivity in order to advance a career as an independent scientific worker.

Scientific biographies have often treated their subjects with a piety that often strays into hagiography or with a studied distain for scientists' lives beyond the laboratory door (Shapin, 2010). Greene (2007: 798) counsels against scientific biography couched in this vein since it tends to be weak history, because while 'a single life may be rich with vivid and absorbing detail…it acquires historical meaning and significance only when it is folded into a narrative stronger than itself'. Notwithstanding this advice it is not a question of avoiding the biographical because, as Shapin (2008) argues, we cannot understand science, its power and indeed its relationships of mobility without also seeking to appreciate the power of the personal values of those who perform science. To this end, the paper focuses on Cockayne because he was arguably the most strategically significant of an interlinked group of late nineteenth and early twentieth century New Zealand botanists that included Cockayne's Auckland based colleague Thomas Cheeseman (1845–1923), the gifted administrator Thomas Kirk (1856–1936), and the Anglican priest and lecturer John Holloway (1881–1945). He is significant both because of the honours attached to his career and because of his position within a complex web of relationships that spanned the public and the private, the amateur and the professional, the academic and the popular, and the pure and the applied.

In concentrating on Cockayne we need to be mindful of the 'filial piety' that Hoare (1976) identifies as endemic to the writing of scientific biography. To help chart a path through these shoals Barnes (2001) introduces a distinction between 'lives lived' and 'lives told' in writing scientific biography. 'Lives lived', suggests Barnes (2001: 412), is a narrative strategy which presents individual biography in terms of its final accomplishments. Under this approach, 'science produces the scientist, and not the other way around.' Narrated in this way the scientific life becomes a 'black box' where what is made transparent to the reader are the initial inputs and most significantly the finished products of ideas, discoveries, laws, equations, publications and so on that constitute the stuff of science. Such an approach is unsatisfactory because it ignores the messy, contingent socio-scientific practices that frame and make possible those products. Conversely, a 'lives told' approach to biography emphasises

the practice of a scientific life. Framed in these terms, 'scientists are not faceless organs of scientific rationality, but real people with particular kinds of socially defined bodies, histories, skills, and interests' (Barnes, 2001: 412). Dethroned from their positions as the mediums of pure cogito the 'lives told' of scientists forces us to look for apertures through which to discern the lived realities of socio-scientific practice. Guided by this notion of a 'life told', the narrative that follows focuses less on Cockayne's myriad awards and finished botanical works, and more on the ethos, practices and negotiations that framed his personal and professional relationships and which can be glimpsed through his extensive correspondence (for a bibliography of Cockayne's work see A.D. Thomson, 1982). This series of relationships can moreover enable us to glimpse the wider constellations of mobility framing the world of early twentieth century science in New Zealand.

Writing in the mid-1970s, Hoare (1976: 10–11) notes a conundrum between a common disavowal of intellectual life in New Zealand and the reality that 'science in the broadest sense has long been a "grass-roots participation" affair' and that 'elitism and specialisation have been significant threads in the scientific story of the last fifty years but have never completely dominated at the expense of a broadly based support which has given strength to local museums and bodies alike'. In 1924 the *New Zealand Journal of Science and Technology* published a survey of scientific activity in New Zealand (J.A. Thomson & Thomson, 1924). Cockayne was identified as one of a small number of independent researchers working outside the formal structures of science in New Zealand. Organisations included the Department of Agriculture (established in 1893) (Nightingale, 1992), Dominion Museum (Burton, 1965), Geologic Survey (Dell, 1965), and State Forest Service (established in 1919) (Roche, McLean, & Galloway, 1990), the private Cawthron Institute (established in 1919) (Miller, 1963), and the growing work of academics within the federated colleges of the University of New Zealand (Parton, 1979). By the late 1920s many of the agencies identified in the 1924 survey had coalesced into the newly created Department of Scientific and Industrial Research (DSIR) (established in 1926) (Galbreath, 1998). Surrounding and supporting these institutions was a continuing ethos of volunteer, scientific work embedded in a network of urban-based scientific societies federated to the New Zealand Institute (founded 1867 and reconstituted as the Royal Society of New Zealand in 1933) (Fleming, 1987). Notwithstanding these changes in the 1920s the world exposed by the *Journal of Science and Technology* had been, and continued to be, an intimate scientific community and it was a community within which scientific workers such as Cockayne wove careers that were simultaneously amateur and professional, public and private, independent and dependent.

While Cockayne's life and career has not been subject to a full-length biography it has been widely rehearsed (Anonymous, 1919; Godley, 1979; Moore, 1967; RML, 1936; A.D. Thomson, 1978; A.D. Thomson, 1983). He was born at Norton Lees (near Sheffield, England) in April 1855 to a mildly prosperous family. Educated by a private tutor he later attended both Wesley College (Sheffield) and Owen College (Manchester) between 1872 and 1875 where he studied medicine, but because of ill health never graduated. In 1877 Cockayne immigrated to Australia where he worked as a teacher in Tasmania, Victoria and Queensland before shifting across the Tasman in 1881 to continue teaching in Otago.

Beyond the first chapter of an uncompleted autobiography which highlighted the pleasure that Cockayne took as a child in exploring the woods of his home at Norton Lees, the details of his life and botanical interests are vague before his public emergence in the mid-1890s. Moore (1967) notes that it was unlikely given the state of botanical education in the United Kingdom that he ever had any training in botany, although later research by Thomson (1983) suggests Cockayne had some level of formal exposure to botany while he was at Owen College. Nonetheless it appears that he was teaching basic botany as part of his primary school classes in Otago. What these fragments suggest is that Cockayne's botanical interests started at an early age, and he was enthusiastic enough to incorporate those interests into his teaching career. Moreover it was during this period of teaching that Cockayne seems to have developed his defining interest in native New Zealand plants from an association with the education inspector Peter Goyen and his reading of G.M. Thomson's (1882) classic *The Ferns and Fern Allies of New Zealand*.

The death of Cockayne's father in 1884 left him with a small income that gave him the degree of financial independence that enabled him to leave teaching (which he loathed) and devote himself fulltime to a career in botanical research. In 1885 after resigning from his teaching job he bought a property, 'Dilcoosha', at Styx north of Christchurch. Here he gradually developed an extensive garden of flowering plants, including the daffodils that he was passionately fond of (Moore, 1967). In addition to flowers, which probably also had a commercial focus, Cockayne also started growing at 'Dilcoosha' the alpine plants collected during the botanical trips he had begun to take throughout the South Island's Southern Alps with his friend and mentor Robert Brown. This collection of flowering and alpine plants steadily grew and by the early 1890s Cockayne had resolved to buy a larger property in the Christchurch seaside suburb of New Brighton to establish what he called his 'experimental garden' and devote himself to horticulture and New Zealand botany (Anonymous, 1919).

This second garden, which Cockayne named 'Tarata', represents a pivotal place in his emerging scientific career. At 'Tarata', a property he described as being, 'about one mile from New Brighton, Canterbury, situated at the base of sand hills and watered by a small stream' (Cockayne to Halcolme 18/8/1925 in A.D. Thomson, 1980: 426) he quickly set about remodelling the property, 'so that I can have all kinds of aspects and stations with regards moisture' (Cockayne to von Goebel 27/10/1899 in A.D. Thomson, 1979: 390). The mention of moisture is important because the defining botanical question of Cockayne's career would become the relationship between plant morphology and environment, and the extent to which the former adapted to changes in the latter (Godley, 1979).

The experimental landscapes created at 'Tarata' enabled him to move the alpine plants, which were his growing botanical passion, from their original ecosystems in the Southern Alps into more controlled environments that were constantly accessible and modifiable by him. Cockayne continued expanding his collection at 'Tarata' through the exchange of seeds and cuttings with fellow collectors and botanical gardens such as at Kew and Munich. The result was that 'the collection rapidly increased to thousands of herbs, alpine plants, trees and shrubs' (Anonymous, 1919: 231). Cockayne's fashioning of an explicitly labelled 'experimental garden' signalled a self-appraisal of his own botanical work as comprising something more than simple collecting. Here his interest lay not simply in constructing new landscapes which would enable the replication of alpine ecosystems, nor the acclimatisation of new plants, but rather the creation of an opportunity to study the effects of environmental change on plant morphology. In this vein he proudly noted, for example, that, 'I am especially cultivating marsh plants in the dryer places to study their change if any. *Epilobium macropus* of running subalpine streams is growing magnificently in the driest and hottest part of one of these erections' (Anonymous, 1919: 233). 'Tarata' was sold by Cockayne in 1903 in order that he could, 'give all of his time to pure science' (Anonymous, 1919: 233) and his collections of plants were gifted to the Christchurch Beautifying Society where many of them can still be seen on the banks of the River Avon in Christchurch (A.D. Thomson, 1978). However, despite the sale of 'Tarata', Cockayne continued a tradition of establishing small experimental gardens wherever he lived to sustain his botanical practices of collection and experimentation.

Up until the mid-1890s Cockayne had largely pursued his collecting and experimental work outside the nascent structures of institutional science in New Zealand, but in 1895 Cockayne entered the realm of public science when he was elected to the Philosophical Institute of Canterbury (PIC). The PIC had been established in the early 1860s as part of the nineteenth century effloresce

of locally based scientific societies in New Zealand (and elsewhere) that included the Auckland Institute, the Otago Institute, and the Wellington Philosophical Society which Cockayne later joined when he moved to Wellington in 1914 (for a discussion of the emergence of urban scientific societies see Alberti, 2001; Elliott, 2003; Finnegan, 2005). It was to the PIC that Cockayne delivered his first scientific address on the selective breeding of flowers in 1896 and read his first paper on the freezing of alpine plants in 1897 (Cockayne, 1897).

Cockayne's emerging botanical career quickly started criss-crossing the complex topography of the 'professional' and the 'amateur' in the slowly disappearing world of late Victorian science (Barton, 2003; Bellon, 2001). While the world of Victorian science was not framed by a categorical distinction between 'professional' and 'amateur' in terms of who could conduct 'good' science, it was nonetheless an intricately layered community shaped by the, 'subordination of helpmates and rank-and-file practitioners within a hierarchically organised community' (Bellon, 2001:53). Status in this community was established, 'not by examinations and degrees… but by fellowships and medals of the Royal Society and other, but lesser, metropolitan scientific societies', and the structure of scientific endeavour, 'included low-paid workers who did routine work, and many enthusiastic amateurs who contributed their expertise by collecting materials for those at the top of the hierarchy to interpret' (Barton, 2003:107). Barton's point about the significance of awards in demonstrating status within the scientific world is particularly apposite in the context of Cockayne's life. Cockayne collected an impressive suite of awards throughout his career, beginning with the award of an honorary doctorate from the University of Munich following his work with the German botanist Professor Karl Ritter von Goebel in 1903 and culminating in the award of the Royal Society of London's Darwin Medal in 1928. Awards that both reflected and enabled his continuing work.

The articulation of this hierarchy in botany was marked by continual negotiations over authority and interpretation between metropolitan based experts and widely dispersed collectors. However, while these relationships were hierarchical, they were also characterised by interdependence insofar as the network being constituted, 'was not a one way flow of plants or authority from periphery to centre but a complex negotiation in which each side bartered its assets according to its interests' (Endersby, 2001:355). This was not simply a game of maximising self-interest, but involved relationships constituted by complex and changing motivations. These negotiations can be clearly seen in the relationship established between Julius Haast and Richard Owen over the exchange of Moa bones. Haast, living in Canterbury, fought to have the Brit-

ish Museum-based Owen recognise his local interpretations of the bones that he was sending overseas (Barton, 2000). On this score Haast's expectations affirmed a desire to interpret independently from the traditional centres of authority represented by Owen and the concomitant belief that peripheral collectors had an interpretative credibility by virtue of their localised, situated knowledge. Working a number of years later, and in a different discipline, Cockayne was nonetheless also working in a community that was similarly dispersed and governed, and within which many of the same tensions existed about the distribution of authority. These tensions were sharpened for Cockayne by his own growing belief in the importance of an ecological rather than strictly taxonomic approach to botany, a belief that, in its drive to record and interpret ecological assemblages, implicitly decentred authority from calculative centres such as Kew Gardens in London.

The deft concern for the status and interests of his correspondents, displayed in his letters, demonstrated that Cockayne understood the dynamics of the botanical community's hierarchy. This was especially the case in relation to key agents, such as Sir Joseph Hooker and Professor Karl Ritter von Goebel, who in centres such as London's Kew Gardens or at the University of Munich had the power to recognise and accord status to colonial scientific workers (Barton, 2000; Endersby, 2001). Cockayne's success in mobilising these patronage networks can be seen in his election as Fellow in 1912 to the Royal Society, supported by Sir James Hooker and a veritable galaxy of notable botanists including the serving Director of Kew Gardens, Donald Prain, and his immediate predecessor William Thiselton-Dyer. Cockayne's election as Fellow on only his second attempt (he had also tried in 1911) was remarkable given the New Zealand focus of his botanical work and his own international immobility which saw him never return to the United Kingdom. Home (1991) contextualises Cockayne's success by noting the enduring difficulties that Australasian scientists had in securing metropolitan recognition for their work and in maintaining from afar the collegial networks necessary for election. An observation sharpened by the reflections of Cockayne's contemporary, Thomas Cheeseman on his earlier application for fellowship, 'I was quite ignorant as to the conditions for election and had no idea that a <u>personal</u> acquaintance with the candidate was required of the chief proposer.... In any case this is not easy given that I have resided in New Zealand since boyhood, and that we have now only one fellow of the society in New Zealand [Sir James Hector]' (Cheeseman, 1/2/1907, unpaged).

External recognition reflected and affirmed Cockayne's status as a scientific worker, and he recognised the importance of creating and presenting what he

considered to be a properly scientific subjectivity within the hierarchy that he worked. In correspondence to Sir William Turner Thiselton-Dyer, then Director at Kew, he pointedly referred to himself as no 'nursery gardener' whose interests were commercial in nature, but rather as 'merely a private individual who spends his whole time in the study of Botany' (Cockayne 15/8/1899 in A.D. Thomson, 1980: 407). Yet while Cockayne was actively seeking to fix his scientific identity as an independent scientific worker within the hierarchical structures of the botanical community, he also chaffed at the intellectual authority accorded to institutions such as Kew Gardens, where that authority clashed with his own vision of botanical science as it existed in New Zealand. Early on in correspondence to von Goebel he complained that 'the English botanists do not seem very anxious to encourage their antipodean brethren' (Cockayne 26/8/1902 in A.D. Thomson, 1979: 293), whilst complaining a number of years later that the forthcoming arrival of the Director of Kew in New Zealand would do much botanical good to the country since, 'the Government will listen to Kew, but not to L.C.' (Cockayne 29/8/1927 in A.D. Thomson, 1979: 398). These complaints reflected the continuing intellectual power geometries mooring New Zealand's scientists and administrators to legitimising institutions, such as Kew Gardens and the Royal Society, and to individuals such as Sir Joseph Hooker.

THE FRENETIC MOBILITIES OF LEONARD COCKAYNE

Cockayne worked within a milieu in which he spent significant efforts attempting to produce an identity as an independent scientific worker. The effort to do so was worthwhile because it helped moor the socio-scientific status that would enable the mobility that marked his botanical collecting and indeed his vision of good scientific practice. A feature of Cockayne's botanical practice was his relentless movement, a feature that he shared with many of his fellow botanical workers. The sheer extent of his travels is captured in Hamlin's (1967) patient reconstruction of his fieldwork itineraries between 1888 and 1932 and exemplified by Thomson's (1983) calculation that at the height of his career between 1918 and 1925 he was in the field on average for over one hundred days a year.

In the early years of his career this movement was focused on fieldwork in the South Island's alpine regions, especially the area that would become the Arthur's Pass National Park in 1929. Between 1893 and 1900 Cockayne visited the mountains of Arthur's Pass annually. Here fieldwork was not a solitary affair. In 1893 he spent time in the mountains with Donald Petrie; in 1897/98 six weeks with the German botanist Karl von Goebel would prove enormously

important for Cockayne's later career; and he also had regular visits with his mentor Robert Brown (Burrows, 1986). As Cockayne's reputation developed, and with it the material resources available to him, Hamlin's (1967) itineraries show that he moved widely throughout New Zealand. This movement was not simply Brownian motion, but had a definite rhythm and direction at a number of scales. It is no surprise given Cockayne's interest in alpine plants that the bulk of his travelling occurred during summer. In this respect, his travels were not that dissimilar from the patterns of movement of contemporaries such as Thomas Kirk (Hamlin, 1965) and Donald Petrie (Hamlin, 1958). Thus, for example, in 1900 we find Cockayne beginning the year conducting fieldwork on the Crawford Range in New Zealand's Southern Alps and down the Poulter and Waimakariri Rivers. This fieldwork was interrupted by trips to Wellington and Palmerston North in March, before resuming in Arthur's Pass during autumn. The onset of winter confined Cockayne to his experimental garden at Tarata, before he again ventured out into the field in the summer of 1901. The rhyme of regular, seasonal fieldwork that Cockayne adhered to throughout his career was counterpointed by a series of intensive expeditions. Following on from his work in the Southern Alps during the summer of 1900, Cockayne's fieldwork in the summer of 1901 involved six weeks surveying on the Chatham Islands, while in 1903 he was involved in a winter expedition to the sub-Antarctic, Auckland and Campbell Islands (Hamlin, 1967; Moore, 1967). Finally, Cockayne's peripatetic fieldwork was also framed around his own changes in residence from 'Dilcoosha' to 'Tarata' in Christchurch and then from 'Tarata' to Wellington, briefly in 1904 and permanently from 1914 onwards. Changes all framed around Cockayne's own developing sense of a career trajectory.

Given this rhythm of movement and the relentless fieldwork that characterised it, we can ask: what motivated Cockayne to enact his mobilities in this way? An answer to this question can be seen in his reflections on both the nature of botany and the wider development of New Zealand. Throughout his career Cockayne repeatedly articulated in both his writings and in his own practice the importance of fieldwork as the basis of botany. Fieldwork and collecting had long been at the core of botanical science. However, for Cockayne the necessity of botanical fieldwork was given additional emphasis by his strident articulation of an ecological rather than strictly taxonomic approach to botany: an approach which focused on the interpretation of the distribution and variability of plants in ecological systems rather than on their individual morphology (Godley, 1979). On this point he disputed the traditional approach of the field botanist, typified by his patron Sir Joseph Hooker, by suggesting that, 'Previously the one object of a field botanist, no matter how well the flora of a region was known, was usually to collect specimens, dry them and store

them away in a herbarium, whose dried and most unnatural contents were available for study' whereas 'plants are now being studied as living organisms' (Cockayne, 1926: 274–282). The shift advocated and practised by Cockayne required the development of a botanical methodology that enveloped plants in dense textual webs, the effect of which would be to help immobilise the ecosystem relationships between specimens as they were moved between places such as his experimental gardens, herbariums such as at Kew, and his fellow botanical investigators. He spelt out this necessity in a letter to John Yeates, then studying at Cambridge, concluding that 'no one from a dried specimen can do more than make a guess at its taxonomic status, unless he has a great amount of carefully-collected material … supported by copious field-notes as to the individual status of such plants' (Cockayne 29/3/1927 in A.D. Thomson, 1980: 427). Cockayne's insistence on the need to study living plants required botanists to undertake repeated bouts of fieldwork, to be prepared to circulate specimens as living plants rather than the traditional 'immutable mobile' of the dried, pressed specimen, and, finally, to encase plants and preserved specimens in a descriptive web that would hopefully fix some sense of the ecological assemblage within which the plants had originally been found.

Cockayne's methodological insistence on mobility should also be seen in the light of the profound environmental and technological transformations occurring in New Zealand (Brooking, Pawson & Star, 2010; Pawson & Brooking, 2002). The years of Cockayne's career saw dramatic changes in transportation and communications technologies that transformed the perception of time and space during the twentieth century (Kern, 1983). In New Zealand these changes manifested themselves in the arrival of the trans-Tasman telegraph linking New Zealand to the world in 1876; improvements in shipping that saw mail between the Dominion and the United Kingdom taking between 40–70 days by the 1880s rather than the previous standard of three to four months; and the completion of the main truck railway in 1908 linking Wellington and Auckland via an overland route (Churchman & Hurst, 2001). However, it was the gradual extension of a rail network throughout the South Island which most altered Cockayne's movements because it rendered his key field sites in the Southern Alps much more accessible and in doing so profoundly reshaped both his movement as a botanist and his sense of the imperative to be mobile.

Cockayne was well aware of the opportunities that the expanding railway network created in extending and speeding up his movement. On this issue he noted in correspondence with his Munich based colleague Karl von Goebel that, 'Our Philosophical Institute at my suggestion, now that the railway from Christchurch is right into the Southern Alps, is taking up the matter of put-

ting up a hut in the mountains to serve as a small laboratory and to have a mountain garden' (Cockayne 28/12/1906 in A.D. Thomson, 1979, p. 395). However, while Cockayne recognised these opportunities he also realised that in order to make full use of them he needed to embed himself within wider socio-political relationships of mobility. To this end he started actively lobbying in 1906 to have the New Zealand Institute (NZI) support his bid to have the government create a position of 'Government Botanist' for him. If such a position was forthcoming he proclaimed, 'I should be able to travel everywhere in N.Z. and not any longer at my own expense!' (Cockayne 28/12/1906 in A.D. Thomson, 1979: 395). Whilst Cockayne's lobbying for the position of Government Botanist was unsuccessful (indeed no such position was created) in late 1907 the Lands Department asked him to conduct a series of botanical surveys of New Zealand's different landscapes (A.D. Thomson, 1982). Undertaking this work, he enthused, would mean that, 'my coach, railway, boat, cabs and other locomotion expenses are all paid for and I have such men, packhorses, material etc. as I require!' (Cockayne 7/11/1907 in A.D. Thomson, 1979: 396). Such a position would also have other advantages in enabling Cockayne to publish and circulate his work in a more durable, credible form insofar as 'the Government will publish all my work – not as the Kapiti Report – but much better in style and uniform with that of the new Geological Survey' (Cockayne 7/11/1907 in A.D. Thomson, 1979: 396). Given these benefits it was no surprise that he referred to his political benefactor as the 'enlightened and highly educated Minister of Lands' (Cockayne 7/11/1907 in A.D. Thomson, 1979: 396). More profoundly it also illustrates the extent to which Cockayne's movement was not simply a matter of technological capacity, but involved ongoing political work to orchestrate mobility that mirrored his adroit negotiation of the hierarchies of the international botanical community in fixing his own scientific identity.

Cockayne completed five surveys for the Department of Lands and Survey between 1907 and 1911, and in 1923 he was again contracted by the New Zealand Forest Service to make a survey of the *Nothofagus* forest area (see A.D. Thomson, 1982). Despite his initial reluctance to do this *Nothofagus* survey he later enthused in a letter to Sir Arthur Hill, then Director of Kew Gardens, that the appointment came with the help of the Forest Service's rangers and promises of transportation that would enable him to move rapidly in his fieldwork. Movement that he was canny enough to indicate would provide 'excellent circumstances to procure botanical material for Kew. Now I want to know how I can be of the best use' (Cockayne, 19/2/1923).

However, alongside his recognition and mobilisation of the emerging opportunities provided by the orchestration of these governmental relationships,

he also reflected on the environmental threats posed by improved transport technologies and the concomitant development of New Zealand as a tourist destination. In response to government plans to introduce various forms of trophy animals for sport hunters he complained that 'if these brutes come into the land, then farewell to *Ranunculus lyallii* and all its fair train and farewell to your [von Goebel's] moist liverwort laden gullies when the undergrowth is destroyed and the ground trampled hard' (Cockayne 16/01/1901 in A.D. Thomson, 1979: 392). The relentless extension of the telegraph, steamer services, roads and the railway led Cockayne to reflect to von Goebel that 'New Zealand shrinks and shrinks like Balzac's peau de chagrin' (Cockayne 16/01/1901 in A.D. Thomson, 1979: 392). In the Southern Alps where he had done much of his fieldwork, he wrote that 'it is no longer the quiet spot you [von Goebel] saw, but excursion trains take 1000 or more people at a time' (Cockayne 16/01/1901 in A.D. Thomson, 1979: 392). In the case of Arthur's Pass, at least, he was confident that while the railway could bring people to the Southern Alps, 'happily the mountains are not too easy to climb, nor the rivers to cross and many fastnesses will remain not degraded' (Cockayne 23/5/1927 in A.D. Thomson, 1979: 398).

If Cockayne decried the bustle of tourism in Arthur's Pass, he was himself instrumental in helping 'open-up' the area for his fellow botanists. Alongside his gardens at Styx and later Dilcoosha, Cockayne also owned a small cottage at Kelly's Creek where he regularly hosted botanical visitors for trips into the surrounding mountains (Burrows, 1986). Cockayne's enthusiasm for Arthur's Pass as a natural laboratory led him to advocate to Charles Chilton and Robert Speight, respectively Professors of Biology and Geology at Canterbury College, for the establishment of a field station initially proposed for a site at Broken River and then finally established in Cass in 1914 (Burrows, 1977). A shift prompted, ironically given Cockayne's comments, by the ongoing development of the railway through Arthur's Pass. The formally named Canterbury College Mountain Biological Station, Cass (immortalised in paint by Rita Cooke's 1936 *The Cass Field Station*), hosted its first group of students in November 1914 and it continues to host students to the present day.

An elegiac note was sounded when he commented to William Hemsley that in Christchurch, 'Here New Zealand is gone' as exotic species became more prevalent before concluding more hopefully that in Wellington there still existed, 'fine forest virtually primeval' (Cockayne 5/01/1914 in A.D. Thomson, 1980, p. 408). To Sir James Hooker he contrasted the primeval landscape at Dusky Sound which he described as untouched since Captain Cook's stopover with many other parts of New Zealand where, 'the native vegetation being almost

entirely replaced by European invaders and the whole landscape much more English than antipodean' (Cockayne, 2/01/1905). Cockayne's correspondence with von Goebel and others is replete with his reflections upon the changing landscape with which he was confronted in this fieldwork. In this context he was forced to search deeper for the remaining traces of a 'primeval' New Zealand using those selfsame transportation technologies that he knew would almost inevitably transform them.

There is an irony in Cockayne's complaints as to the loss of primeval New Zealand insofar as his earlier botanical gardens had contained significant collections of those self-same 'European invaders' (A.D. Thomson, 1978). At 'Tarata' for example Cockayne was reported to be sowing approximately 2000 species of exotic plants annually (Anonymous, 1919). In the same letter to Hooker in which he described New Zealand's changing landscape as 'more English than antipodean', he approvingly noted the vigour of Himalayan rhododendrons growing in a nearby garden, adding that, 'In my former garden on the Canterbury Plains near the sea [Tarata], I grew a number of Himalayan alpine plants, several species of Primulas being luxuriant + growing side by side with cultivated Celmisias + Ranumculus Lyallii' (Cockayne, 2/01/1905). Likewise to von Goebel he acknowledged the receipt of a number of plant specimens proudly exclaiming that, 'Just think, I have now growing well in my garden the following which I had never thought to see alive in New Zealand: *Equisetum* four species... *Eriophorum* two species. *Primula viscosa* and *Centiana lutea!*' (Cockayne 12/04/1900 in A.D. Thomson, 1979: 390). He was aware of the dangers posed by the growing of exotic species in New Zealand, for example informing von Goebel that the *Equisetums* which he had proudly mentioned in a previous letter had had to be destroyed, since, 'they would become a nuisance in my lifetime and I should be hanged, while a N.Z. contingent would proceed to Munichen to arrest you' (Cockayne 16/10/1901 in A.D. Thomson, 1979: 392). Over time Cockayne became increasingly less tolerant of the plethora of plant introductions, writing later in life that, 'The less we have to do with the Acclimisation Society the better… it was a dangerous thing to allow any sort of muck to be brought in' (Anonymous, 1925: 682). Sentiments such as this, his work to establish the Otari Open Air Native Plant Museum in Wellington, and his advocacy for scenic reserves and national parks suggest that towards the end of this career a preservationist ethos had to some extent replaced the acclimatisation ethos which had been a feature of his early work in Christchurch.

As Cockayne's earlier excitement about the acclimatisation of new species indicates, the collections that he developed at 'Dilcoosha' and 'Tarata' were partly founded on an intricate network of botanical exchanges where what was

mobile was not the botanist, but rather packets of seeds, cuttings and the like. Cockayne, like his fellow collectors, spent a significant amount of energy and invention trying to ensure that the packets of botanical samples travelled as immutable mobiles. Such effort at putting these materials into circulation was a reflection of the importance of the mobility of such materials in establishing the ties of collegiality that bound widely dispersed botanical communities together. As Endersby (2000) suggests, participation in such exchanges was bound up in a moral economy that emphasised the gifted nature of botanical exchanges and whose successful exchange helped geographically, if not relationally, isolated botanists such as Cockayne perform within the hierarchies of an international scientific community.

The significance of such botanical exchanges can be seen throughout Cockayne's letters, in conversations about packages sent and received, the best ways of storing and transporting the packages and, as we have seen, the potential rewards of botanical discovery and novelty. It can also be seen sharply illustrated in Cockayne's reaction to what he felt was a breach of this ethos by one of his colleagues in Auckland. Writing to von Goebel in late 1912 Cockayne enthused over the recent arrival of a botanically minded parson, J.E. Holloway, who had a particular talent for spotting *Lycopodium* (a genus of clubmoss). As a student Holloway had sent collections of *Lycopodium* to Professor A.P.W. Thomas at the University of Auckland to be interpreted and written up (Thomas was Professor of Biology and Geology). However fumed Cockayne, 'Thomas is a "dog in the manger", he *will* not work up material himself, nor pass it over to anyone else, unless it be a student in his laboratory, and so this interesting material has been neglected for 8 years!' (Cockayne 31/10/1912 in A.D. Thomson, 1980:397). Such scorn reflected the importance of the movement of botanical samples for the ongoing work of botanical communities. It also reflected the ways in which the physical movement of botanical materials was wrapped up in a moral economy that emphasised the role of botanical gift-giving and exchange in constituting scientific identities and relationships. Cockayne's anger at Thomas can also be situated more specifically in his own belief in the rapid disappearance of New Zealand's indigenous vegetation, and the imperative to quickly document that ecological knowledge before it was lost, knowledge that could not be recreated from herbarium specimens alone.

Viewed through his correspondence, Cockayne was caught in a paradox. On the one hand his very work as a botanist was predicated upon his ability to freely move himself, colleagues and specimens between 'the field' and various interpretive centres. Yet as he himself recognised the improvements in technology which enabled his own movement meant the almost inevitable

disappearance of the 'forest virtually primeval' which he valued as a botanist. Consequently, in Cockayne's experiences of his mobility we can begin to see the playing out of a moral imperative framed by the need to be in constant movement and to engage in what Hilliard (2000) in another context has termed a 'salvage' trope that would enable the documenting and capture of New Zealand's 'primeval' landscapes before they were profoundly changed by humans and introduced species. A process which received its most overt expression in the establishment of the Otari Open Air Native Plant Museum in 1927, intended to bring together and preserve representative ecosystems from New Zealand's disappearing native botanical landscapes.

The desire to engage in these acts of salvage profoundly shaped how Cockayne understood and justified his movements in seemingly contradictory ways. On the one hand, as we have seen, it resulted in almost frenetic activity as Cockayne moved (both himself and specimens) around geographically disparate field sites, and between those sites and his experimental gardens (firstly in Christchurch and latterly in Wellington). Yet at the same time this need to be mobile and to make mobile was framed and made meaningful by a refusal to engage in other forms of movement. This was most notably expressed in Cockayne's refusal, despite numerous opportunities, to travel overseas to Australia, the United Kingdom and the United States. In one sense Cockayne's repeated refusals were based on quite practical reasons. Throughout the First World War he argued that given the severe shortage of shipping space it was not the time for scientific 'jollies'; whilst by the mid-1920s he was entering his 70s and with such gradually failing that eyesight even his beloved fieldwork was becoming difficult (Cockayne, 5/01/1925). Yet his objections went beyond the simply practical, and touched upon the ethic which he attached to his work and in particular the work of salvage. An ethic that was typified in a letter to von Goebel where he turned down an invitation to visit Germany with the excuse that there was work in New Zealand 'that must be done' (Cockayne 23/5/1927 in A.D. Thomson, 1980, p. 398). It was as if he feared that should he travel abroad he would return and New Zealand and its distinctive ecologies would truly 'be gone'.

CONCLUSION

Cockayne's botanical work was marked by relentless motion as he travelled throughout New Zealand conducting botanical fieldwork. Yet, following the mobilities literature that has framed this paper, this movement was not abstraction without meaning. Cockayne attributed significant meaning to his travels in a number of ways. His botanical work was based on the need for con-

stant, detailed fieldwork; work that required his movement to specific, often isolated field sites. However, such travel was filled with anxiety insofar as the very technologies that enabled Cockayne's movement – the steam ship, railway and the motor car – also enabled the movement of other people and plants and the potential destruction of those selfsame places. In reflecting upon this tension, Cockayne's correspondence was characterised by the articulation of a salvage trope in which he rendered this potentially ambiguous movement meaningful through the need to search out and record the vanishing 'primeval forests' of New Zealand's landscapes.

What broader sense might we make of Cockayne's career? Most immediately it reinforces the situated character of science as practised by actors in and between places. Thus, Cockayne's imperative to move, and to be constantly active in circulating ideas and specimens, can only be understand in relation to the wider context of the dramatic landscape changes that he experienced in New Zealand during the first decades of the twentieth century. As the paper has demonstrated, Cockayne's mobility was carefully fabricated from a wide range of relationships and moreover these relationships also displayed a concomitant concern with the fashioning of fixity. Tracing the complex relationships of mobility and immobility in Cockayne's career exposes the extent to which by being attentive to the contextualised 'lives told' of scientists we can become increasingly aware of the practice of science as being constituted *vis-à-vis* notions of a moral economy rather than simply a technical activity. Throughout his correspondence Cockayne repeatedly asserted the importance that he placed on both his own movement and the movement of objects and information as necessary facets of practising good science. The imperative of mobility, then, was not simply a brute fact, but was rather an activity deeply wrapped into his own conception of what constituted the work of good science and the life of a good scientist.

Finally, Cockayne was not alone in his work. Throughout this paper we have seen that Cockayne's career was fashioned in relation to a diverse array of colleagues, acquaintances and allies: relationships that enabled his mobility and burnished his reputation. As we seek to try and interpret the intersection of science and mobility in New Zealand understanding this wider cast of characters becomes increasingly important because in them we should be able to discern more complex and nuanced constellations of mobility. Constellations of mobility, framed by the issues of hierarchy, discipline and geography which have been touched on in this paper, will find their specific articulation in the detailed, piecing together of the 'lives told' of New Zealand's scientific workers and importantly their relations and geographies of connection. Cockayne has

provided us with an aperture through which we can glimpse an intricate and intimate community with its own varied dynamics of mobility, an engagement with which would deeply enrich our understanding of the diverse cultures of science, their spatial and temporal change, and their points of entanglement with the wider cultures they have been, and continue to be, embedded within.

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REFERENCES

Adey, P. 2003 'Secured and sorted mobilities: Examples from the airport', *Surveillance & Society,* 1(4): 500–519.

Adey, P. 2010 *Mobility*. London and New York: Routledge.

Agar, J. 2003 *Constant Touch: A Global History of the Mobile Phone*. Cambridge: Icon.

Alberti, S.J.M.M. 2001 'Amateurs and professionals on one county: biology and natural history in late Victorian Yorkshire', *Journal of the History of Biology,* 34(1): 115–147.

Anonymous. 1919 'Biographical notice: Leonard Cockayne, Ph.D., F.R.S., President of the New Zealand Institute', *New Zealand Journal of Science and Technology,* 2(4-5): 231–234.

Anonymous. 1925 'Plant improvement', *New Zealand Fruit Grower and Apiarist,* 7: 682.

Barnes, T.J. 2001 'Lives lived and lives told: biographies of geography's quantitative revolution', *Environment and Planning D: Society and Space,* 19(4): 409–429.

Barton, R. 2000 'Haast and the moa: reversing the tyranny of distance', *Pacific Science,* 53(3): 251–263.

Barton, R. 2003 '"Men of science": language, identity and professionalization in the mid-Victorian scientific community', *History of Science,* 41(1): 73–119.

Bellon, R. 2001 'Joseph Dalton Hooker's ideals for a professional man of science', *Journal of the History of Biology,* 34: 51–82.

Blunt, A. 2007 'Cultural geographies of migration: mobility, transnationality and diaspora', *Progress in Human Geography,* 31(5): 684–694.

Brooking, T., Pawson, E. and Star, P. (eds) 2011 *Seeds of Empire: The Environmental Transformation of New Zealand.* London: I.B. Tauris.

Burrows, C. 1986 'Botany of Arthur's Pass National Park South Island, New Zealand 1. History of botanical studies and checklist of the vascular flora', *New Zealand Journal of Botany,* 24(1): 9–68.

Burrows, C. (ed.) 1977 *Cass: History and Science in the Cass District, Canterbury, New Zealand*. Christchurch: Department of Botany, University of Canterbury.

Burton, P. 1965 *The New Zealand Geological Survey 1865–1965*. Wellington: Department of Scientific and Industrial Research.

Cheeseman, T. 1/2/1907 *To Joseph Hooker*. Kew Gardens Library and Archive, (JDH 1/2/4). London.

Cockayne, L. 2/01/1905 *To Joseph Hooker*. Kew Gardens Library and Archive, (JDH 1/2/4). London.

Cockayne, L. 5/01/1925 *To Arthur Tansley*. Auckland War Memorial Museum Library, (MS 90/55). Auckland.

Cockayne, L. 19/2/1923 *To Arthur Hill*. Kew Gardens Library and Archive, (DC v.169). London.

Cockayne, L. 1897 'On the freezing of the New Zealand alpine plants: notes of an experiment conducted in the freezing-chamber', *Transactions and Proceedings of the New Zealand Institute,* 30: 435–442.

Cockayne, L. 1926 'Notes on ecological field work in New Zealand', in A.G. Tansley and T.F. Chipp (eds), *Aims and Methods in the Study of Vegetation.* London:

The British Empire Vegetation Committee and The Crown Agents for the Colonies: 274–282.

Cresswell, T. 2006 *On the Move: Mobility in the Modern Western World*. New York: Routledge.

Cresswell, T. 2010 'Towards a politics of mobility'. *Environment and Planning D: Society and Space,* 28(1): 17–31.

Cresswell, T., and Merriman, P. (eds) 2008 *Geographies of Mobility: Practices, Spaces, Subjects*. Aldershot: Ashgate.

Deleuze, G. 1992 'Postscript: on the societies of control', *October,* 59(Winter): 3–7.

Dell, R. 1965 *Dominion Museum, 1865–1965*. Wellington: Dominion Museum.

Elliott, P. 2003 'The origins of the "creative class": provincial urban society, scientific culture and socio-political marginality in Britain in the eighteenth and nineteenth centuries', *Social History,* 28(3): 361–387.

Endersby, J. 2000 'A garden enclosed: botanical barter in Sydney, 1818–39', *British Journal for the History of Science,* 33(3): 313–334.

Endersby, J. 2001 '"From having no herbarium." Local knowledge versus metropolitan expertise: Joseph Hooker's Australasian correspondence with William Colenso and Ronald Gunn', *Pacific Science,* 55(4): 343–358.

Finnegan, D. 2005 'Natural history societies in late Victorian Scotland and the pursuit of local civic science', *British Journal for the History of Science,* 38(1): 53–72.

Galbreath, R. 1998 *DSIR: Making Science Work for New Zealand: Themes from the Department of Scientific and Industrial Research, 1926–1992*. Wellington: Victoria University Press in association with the Historical Branch, Department of Internal Affairs.

Gieryn, T. 1999 *Cultural Boundaries of Science: Credibility on the Line*. Chicago and London: University of Chicago Press.

Godley, E.J. 1979 'Leonard Cockayne and evolution', *New Zealand Journal of Botany,* 17(2): 197–215.

Greene, M. 2007 'Writing scientific biography', *Journal of the History of Biology,* 40(4): 727–759.

Hamlin, B.G. 1958 'Itinerary of Donald Petrie's botanical expeditions with a bibliography of Petrie's botanical papers', *Records of the Dominion Museum*, 3(2): 89–95.

Hamlin, B.G. 1965 'Itinerary of Thomas Kirk's botanical expeditions', *Records of the Dominion Museum*, 5(14): 93–100.

Hamlin, B.G. 1967 'Itinerary of Leonard Cockayne's botanical expeditions', *Records of the Dominion Museum,* 5(23): 265–276.

Heffernan, M. 2001 '"A dream as frail as those of ancient time": the in-credible geographies of Timbuctoo', *Environment and Planning D: Society and Space,* 19(2): 203–225.

Henry, M. 2008 'Border geostrategies: imagining and administering New Zealand's post-World War borders', *New Zealand Geographer,* 64(3): 194–204.

Hilliard, C. 2000 'Textual museums: collection and writing in history and ethnology, 1900–1950', in B. Dalley and B. Labrum (eds), *Fragments: New Zealand Social and Cultural History.* Auckland: Auckland University Press: 118–139.

Hoare, M. 1976 *Second Cook Lecture 1976: Beyond the 'Filial Piety': Science History in New Zealand: A Critical Review of the Art*. Melbourne: The Hawthorn Press.

Home, R.M. 1991 'A world-wide scientific network and patronage system: Australian and other "colonial" Fellows of the Royal Society of London', in R.M. Home and S.G. Kohlstedt (eds), *International Science and National Scientific Identity: Australia between Britain and America.* Dordrecht/Boston/London: Kluwer Academic Publishers: 151–179.

Kaufmann, V. 2002 *Re-thinking mobility: contemporary sociology*. Aldershot: Ashgate.

Kern, S. 1983 *The Culture of Time and Space 1880–1918*. London: Weidenfeld and Nicholson.

Lambert, D., and Lester, A. (eds.) 2006 *Colonial Lives Across the British Empire*.

Cambridge: Cambridge University Press.

Latour, B. 1987 *Science in action: how to follow scientists and engineers through society*. Cambridge: Harvard University Press.

Law, J. 1994 *Organizing Modernity*. Oxford: Blackwell.

Law, J. 2004 'And if the global were small and incoherant? Method, complexity, and the baroque', *Environment and Planning D: Society and Space, 22:* 13–26.

Law, J., and Mol, A. 2001 'Situating technoscience: an inquiry into spatialities,' *Environment and Planning D: Society and Space,* 19(5): 609–621.

Lefebvre, H. 2004 *Rhythmanalysis: Space, Time and Everyday Life*. London: Continuum.

Livingstone, D. 2003 *Putting Science in its Place: Geographies of Scientific Knowledge*. Chicago and London: University of Chicago Press.

Livingstone, D. 2005 'Science, text and space: thoughts on the geography of reading', *Transactions, Institute of British Geographers,* NS 30*:* 391–401.

Massey, D. 2005 *For Space*. London: Sage.

Miller, D. 1963 *Thomas Cawthron and the Cawthron Institute*. Nelson: Cawthron Institute Trust Board.

Moore, L. 1967 'The Cockayne Memorial Lecture, 1965: Leonard Cockayne, botanist', *Transactions of the Royal Society of New Zealand, General,* 2(1): 1–18.

Nightingale, T. 1992 *White Collars and Gumboots: A History of the Ministry of Agriculture and Fisheries 1892–1992*. Palmerston North: Dunmore Press.

Parton, H. 1979 *The University of New Zealand*. Auckland: Auckland University Press.

Pawson, E., and Brooking, T. (eds) 2002 *Environmental Histories of New Zealand*. Auckland: Oxford University Press.

RML. 1936 'Obituary–Leonard Cockayne', *Transactions and Proceedings of the Royal Society of New Zealand,* 65: 457–467.

Roche, M., McLean, G., and Galloway, T. 1990 *History of Forestry*. Wellington: New Zealand Forest Corporation.

Shapin, S. 1994 *A Social History of Truth: Civility and Science in Seventeenth-Century England*. Chicago and London: University of Chicago Press.

Shapin, S. 2008 *The Scientific Life: A Moral History of a Late Modern Vocation*. Chicago: University of Chicago Press.

Shapin, S. 2010 *Never Pure*. Baltimore: The Johns Hopkins University Press.

Sheller, M., and Urry, J. 2006 'The new mobilities paradigm', *Environment and Planning A,* 38(2): 207–226.

Thomson, A.D. 1978 'Leonard Cockayne: horticulturist', *New Zealand Journal of Botany,* 16(3): 397–404.

Thomson, A.D. 1979 'Annotated summaries of letters to colleagues by the New Zealand botanist Leonard Cockayne 1'. *New Zealand Journal of Botany,* 17(3): 389–416.

Thomson, A.D. 1980 'Annotated summaries of letters to colleagues by the New Zealand botanist Leonard Cockayne 2', *New Zealand Journal of Botany,* 18(3): 405–432.

Thomson, A.D. 1982 'A bibliography of the work of Leonard Cockayne'. *New Zealand Journal of Botany,* 20(3): 205–219.

Thomson, A.D. 1983 *The Life and Correspondence of Leonard Cockayne*. Christchurch: The Caxton Press.

Thomson, G.M. 1882 *The Ferns and Fern Allies of New Zealand: With instructions for their collection and hints on their cultivation*. Dunedin: Henry Wise.

Thomson, J.A., and Thomson, G.M. 1924 'Scientific Research in New Zealand', *The NZ Journal of Science and Technology,* 6 (December): 234–256.

Urry, J. 2007 *Mobilities*. Cambridge: Polity Press.