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Mastering the land: mapping and metrologies in Aotearoa New Zealand

Andreas Aagaard Christensen

The environmental history of New Zealand is one of the clearest and most recent examples of the way humans make a home for themselves in newly explored territory. New Zealand was the last major land area in the world to be colonised by people and, given its extraordinary natural history, the first settlers could hardly have been more surprised when they arrived in the thirteenth century. At the time of this first Polynesian settlement, New Zealand was a land not only without humans, but without any terrestrial mammals except for a few species of bats. In their absence the avifauna had proliferated, and in ecosystems developed with birds as the only large grazers, the flora had developed in ways not seen anywhere else, leaving only limited plant foods available for humans. This must have made New Zealand not only a challenging but also an initially incomprehensible land for newly arrived Polynesians as well as Europeans. This fact makes their success in forging cultural landscapes from the new land all the more interesting for students of environmental history.

As an example of such processes, New Zealand illustrates the way human newcomers learn to master an environment, change the land and its resources, and in the process change themselves. From the 'fragile plenty' of the first Māori to the cultural landscapes in which they lived at the time of the first European discovery, to the settler economy and the modern society of today, New Zealand is an example of the way a society develops on the basis of natural resources which change as the society itself changes. Newcomers to any environment meet it with a set of technologies and a culture which they bring with them and which changes continuously, as it aligns with experience gathered in that environment. The environmental histories told from a multiplicity of viewpoints in this volume are contributions to our understanding of this central dialectical relationship, which over time led to the creation of the landscapes and ecosystems of contemporary New Zealand.

This chapter picks up on a theme which has been touched on in most of the preceding chapters, but which has not been fully unfolded. It argues that while conditions and events changed the relationship between society and environments repeatedly, the history of New Zealand was always a history of spaces and of the ability of its inhabitants to control space and resources cognitively, socially and physically. With this perspective

in mind the chapter outlines the history of production of spatial knowledge about the environments of New Zealand. This is not only to provide an overview of understandings of the environment, but also to investigate and illustrate the close ties between knowledge and practice: between understanding the environment and changing it.

From the narratives employed by Māori settlers to codify and recall important aspects of the environment, to the early maps of European explorers, and from the survey maps of the nineteenth century which commodified the land, to the environmental management and monitoring efforts of the postwar period, New Zealand environments were continuously charted, measured, monitored and mapped. It was through such measuring practices that the resources of New Zealand were discovered, appropriated and organised socially. And the practice of measuring was regulated through systems of measurement called 'metrologies': socially acceptable ways of codifying and describing aspects of the environment, which were brought to New Zealand and adapted to the conditions there by both Maori and European colonisers. The single most important and contested resource to be measured was the land itself, making maps and other map-like metrologies central to understanding the way spatial resources were organised and changed over time.[1] The two types of encounters evident in the history of New Zealand – the encounter between cultures and ecosystems and between two cultures – have one critical characteristic in common: they happened in contested spaces and were centred on the legitimacy and power to take possession of spatially distributed resources for sustenance and wealth.

Māori spaces: narratives and performance

When the first Māori colonists arrived in New Zealand from East Polynesia, their use of the available resources made a drastic imprint on the environment. Starting from an initial state of settlement based on fishing and the hunting of seal and moa, the Māori were able to sustain a rapid population growth, which slowed when the most easily accessible protein food sources became exhausted. In the aftermath of the extinction of large avifauna and with the decimation of seal colonies on the coast, Māori society evolved into a stable state characterised by the establishment of cultural landscapes supporting horticulture alongside hunting and fishing activities. In this period most of the great forest areas of both islands, which contained few other sources for human sustenance than the moa, were removed with fire and replaced by successional fern and tussock cover that could survive continuous burning.[2] This allowed for a diet of starch-rich fernroot to develop and opened up large areas for easy inland travel. It also allowed for the country to be examined more easily, and the improved spatial resolution of the landscape is likely to have influenced the development of the institutions of territory and tribal customary land rights which took place in this period.[3]

As Atholl Anderson has shown in the second chapter of this volume, the organisation of Māori society went through a series of changes in parallel with the changes it wrought on the environment. Horticultural settlements of the type still prevalent at the time of the first European encounters in the eighteenth century represented a different use of

space from the early more transient societies that had less investment in specific landscape resources. The development of horticulture as the primary provider of sustenance necessitated a number of new social institutions and led to the gradual establishment of territories and institutions for resource use allocation between whānau, hapū and iwi.[4] Continuous improvement of the resource base in cultural landscapes of this type further advanced the need for such social institutions. The settlement types that were most widespread at the time when European settlers arrived in the nineteenth century were the result of such processes of social adaptation to environmental change and changes in land use over a prolonged period of time.

While knowledge of the processes that led to the creation of nineteenth-century Māori land use systems is limited, the tenure system that was the eventual result is well understood. As Evelyn Stokes demonstrates in Chapter 3, the Māori society which European settlers were faced with when they arrived was structured around a system of tenure based on specific types of customary land use rights. It was a relationship between land and people centred on use value, which represented a striking contrast to the Judeo-Christian parallel conception of resources and land as something wholly governed by proprietary rights. It was also a conception equally estranged from ideas of capital gain and investment in measurable resources – the kind of systematic transfer of value between social contexts that is characteristic of most Western societies.

Māori tenure and spatial knowledge infrastructure was usufructuary. It was based on a distribution of land use rights among agents, not a distribution of the land or the resources themselves.[5] Traditions and histories of land use (including land use conflicts) relating to specific areas constituted the main point of reference for the establishment of rights to further land use, and as such the tenure system was based indirectly on occupation. Histories of occupation and land use thus formed the basis for claims made regarding legitimate access to resources. This meant that resource use rights overlapped geographically and spatially, with people from different social groups potentially using the same areas at the same time for different purposes, or for the same purposes in a way agreed on or enforced socially. This was a system which did not embrace an institution of private ownership or a concept of alienation in the way known in the west, but which nonetheless was governed through politics of kinship and enforced by military power when needed.[6]

These usufructuary and multifunctional rights to resources in the landscape were communicated and reiterated by way of whakapapa (narratives) recounting mana whenua: genealogies of historical occupation and resource use.[7] This is a system found in many societies that developed without a written language, where narratives were remembered with direct reference to landscape features used as mnemonic cues when retelling the history of the environment.[8] Because Māori topographical knowledge was stored and structured primarily using a narrative technique of this kind, the retelling and transfer of such knowledge about the environment was often performed in the landscape setting with direct reference to the features mentioned. Drawings made on the ground or on other temporary media were also used, but primarily in situations where direct reference to the landscape was impossible or impractical, and as a minor part of the

practice of remembering through spoken narratives.[9] In short, it may be argued that the topographical knowledge infrastructure of Māori society was presentational. It was centred on presenting the environment to a listener through the use of narrative, rather than representing it in an object, a symbol or a text.[10]

When the British explorers and colonisers – the Pākehā – arrived, they brought with them a completely different way of conceptualising space, a different way of understanding the relations between resources and people, and a different political order: all incongruent with those of Māori.

European encounters: placing New Zealand on the globe

Documented European experiences with New Zealand stretch as far back as 1642 with the arrival of Abel Tasman, who charted the western coastline of New Zealand and returned to Europe with the first evidence of a land long mythologised in European scholarship.[11] Europeans may have visited before and many European maps at the time charted a coast at the approximate location of New Zealand, said to have been 'first discovered by a Spanish ship severed from her fleet and driven here along in the southern sea'.[12] Such ideas, whether based on experiences or tales, abounded in Europe at the time and had done since the sixteenth century, forming an intricate mesh of geographical imaginations of the great southern sea. Tasman was, however, the first to bring back documentary evidence, and evidence was important beyond any measure in European culture at this time.[13]

The evidence that Tasman brought back was in the form of maps: in essence a special type of drawing developed since antiquity, which was used to store and communicate experience with surface features of the planet.[14] Maps were regarded as documents of great authority in Europe at this time (as modern maps are today) and were used both as practical spatial tools for orientation and taxation purposes, and as devices to claim territory and demonstrate power and majesty.[15] Because of this authority, maps were used not only for communication, but also as evidence: as replacement experiences. Maps provided a way to effectively transport aspects of a transient experience from the Pacific to Europe or any other destination – and from surveyor to decision-maker and landholder.

The first explorer of New Zealand to tap effectively into the power of representation inherent in the map medium was Lieutenant James Cook, who arrived in 1769 and charted the littorals of New Zealand as the second European observer. His maps of the coast and coastal waters were of such lasting importance to later European and New Zealand navigators and colonisers, that parts of them were still in active use until 1997.[16] With his maps, New Zealand became a possible destination for Europeans, a place among other places on a world map, illustrated in terms of distance and direction from other known territories. This, in essence, was the nature of early European depictions of New Zealand. Through their measurement practices Cook and the navigators who followed him prepared a vital piece of infrastructure for later colonial endeavours, while at the same time adding images of antipodean environments to the appetite for land which was developing in Europe at the time.

Whalers, sealers, lumbermen and merchants in flax and fish were the next to arrive in New Zealand, using their own experiences in combination with the spatial infrastructure provided by Cook and his successors to navigate there. By trading with the Māori those early colonists, the first Pākehā, were able to secure access to the resources and labour they needed to extract valuable commodities for sale on the world market, which was coming into existence at the time as a consequence of such activities. The most important terrestrial commodities were kauri spars for shipbuilding, flax for the weaving of canvas and rope, ship supplies and the range of marine animal products still available. The growing interest in inland resources led to a need for knowledge about the interior of New Zealand, and many of the early maps made to serve that purpose were done with the help of Māori. Willingly and unwillingly, they shared their acquired knowledge of the environment with Europeans, who captured fragments of the information on maps and in written language in order to transmit it to others.[17]

In such instances, where knowledge of the environment was transferred between cultures, the difference between Pākehā and Māori modes of storing and shaping spatial knowledge became clearly visible. There are numerous examples of such exchanges, and in most cases the setting was that of a knowledgeable Māori person recounting a narrative while illustrating it for his European audience with lines and surfaces marked in sand, with chalk on a ship's deck, or on another such surface.[19] The Māori who were employed or forced to service British map makers were *performing* spatial knowledge – shared by way of oral spatial mnemonics – while to the British it was the map as an objective instrument of knowledge storage and retrieval which was thought to perform.

When compared to the Māori tradition of reciting whakapapa to establish mana whenua, the objective and legitimising character of European maps illustrates something quite extraordinary in the makeup of European culture – namely the particular significance of the idea and practice of objectivity itself. For while objectivity was often held high as an ideal for knowledge production in Western societies (and still is today), it was also the privileged counterpart to a host of alternative attributes of knowledge. The ideal of objectivity thus structured an important dichotomy between value and truth, which enabled a seemingly well-defined division line to be drawn in civic life, between authoritative knowledge production on one side, and political process on the other. As the French philosopher Bruno Latour has pointed out, the culture of objectivity that enforces this distinction between autonomous knowledge (objectivity) and independent morality (subjectivity) forms one of the constitutions of Western systems of authority.[19] And maps, which were most often designed with a specific interest in mind, but which were also considered to be authoritative evidence, were a tool able to transgress the partition of civic life and be both scientifically objective and politically biased at the same time. In this way maps were able to provide potentially unquestionable authority for political claims that would otherwise lack such authority, thus '[rendering] ordinary political life impotent through the threat of an incontestable nature'.[20] In comparison with whakapapa whenua, the map was a powerful tool in the colonial setting. For while the European map could be construed as a piece of objective evidence (able to replace fieldwork and direct observation), the whakapapa whenua narrated aspects of

the political, social and spiritual history and reality of the landscape – a completely different purpose, which was of much less significance to the Pākehā officials charged with subdividing New Zealand.[21]

As many of the previous chapters have highlighted, these key differences led to continuous conflicts and bitter grievances, because Māori and European conceptions of authority, legitimacy, land and tenure expressed in terms of the spatial cultures described here, were often mutually exclusive. As a consequence, a large part of the recent history of New Zealand has had to do with differences stemming from disputed spaces. As Evelyn Stokes and Danny Keenan have shown, the conflicts reached their highest point with the work of the native land courts from the 1860s, when British ways of conceiving of tenure and spatial evidence was openly forced on the Māori both officially and in practice.[22] Tenure existed in the eyes of the native land court only if substantiated with evidence in the form of maps or similar documents or statements able to relate claims to the land in question. There are numerous accounts of Māori customary land users singing and narrating their claims to usufructuary rights over prolonged periods in the court, but to no avail. In effect, land could only be held by those who could conform with the spatial technologies endorsed by the court. This position forced many Maori chiefs to react violently, bringing the country into a prolonged series of civil wars which eventually ended in the 1870s when the Crown subdued Māori resistance.

Figure 18.1 Surveyors cutting down bush to make survey pegs, 1903. Pegs were used as proof of tenure inscribed on the landscape and their use was often contested. In 1843, both Māori and Pākehā lives were lost in one such altercation, known as the Wairau Affray, in the northern part of the South Island. Source: 1/2–111812F, National Library of New Zealand, Te Puna Mātauranga o Aotearoa

From then on, because of the success of European colonisers in repressing open resistance, the spatial organisation of New Zealand environments became modelled mainly on European traditions. The rural New Zealand we see today, with its well-delineated grid of property boundaries and its clearcut lines of division between conservation estates and productive land, is partly the result of that heritage of British cultural practices and environmental knowledge technologies. The whole territory is filled out by properties defined by way of cadastral maps and marked by hedges, roads, land use borders and fencelines in the physical landscape. This structure emerged during the latter half of the nineteenth century, when initially there were no such points of reference for marking boundaries and when the standard way to show property boundaries was by using wooden pegs hammered into the ground (Figure 18.1). In this way possessions could be defined even in landscapes where there were no visible or otherwise evident relationships between landscape features and proprietary rights: a practice which attains significance and meaning only in the context of a culture which embraces institutions of private property and documentary spatial evidence.

Making space for settlement: surveying, services and security

When European settlement gained pace in the 1840s and the New Zealand population began to grow rapidly, spatial infrastructure was systematised for the first time. Colonists of many trades were arriving from Europe and were in need of land. And in order to buy it from the Crown that land needed to be well defined on paper. Thousands of surveys ensued to fill the need, and the great majority of maps made of New Zealand land areas in the first part of the nineteenth century were survey maps. A lands and deeds registry was set up in 1841 to care for the storage of land records and maps, and in 1852 six provincial survey offices were established, to take care of the subdivision of land under provincial government.

At this time New Zealand was part of a Pacific frontier in the process of being included into the world commodity market – making it possible for the first time to build export economies.[23] Investments were flowing into New Zealand and maps were needed in order to secure the capital being invested. But as the blank spaces between the isolated survey maps were slowly filled out, these maps alone were no longer enough to secure the safety of capital, the cornerstone of the colonial economy. What was needed was a cadastre: a system of survey maps organised and embedded within a larger scale map of cadastral blocks, which would ensure that all claims were coordinated and never overlapped. The creation of such a system was undertaken in 1877, initiated following criticism from British observers and experts visiting New Zealand at the time. They included a prominent surveyor, Mr Henry Spencer Palmer, representing the Ordnance Survey of Great Britain. He arrived in New Zealand in 1875 and in his report to the government on the state of the surveys, he said that in his opinion the current survey efforts were of little use compared to 'a cadastral map on the correctness of which all men may agree, and which will give safety and value to Crown grants, and protect individuals from litigation, and Government from the risk involved in the issue of land

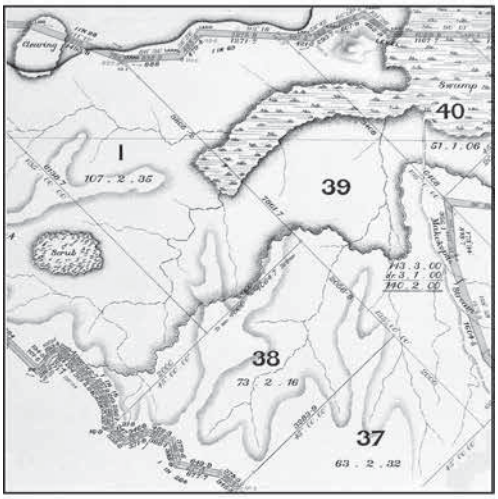
titles under the Land Transfer Act'.[24] The cadastral system that was planned based on these recommendations was not finished until the 1960s, but remained a project of high priority to governments in the prolonged period until it was complete.

The earliest survey maps took account of only just enough context for title boundaries to be discernible in the field. The property boundary pattern with its straight rectangular outlines was the central motif, and its pure geometrical form and economic implication was imposed on a barely legible underlying landscape. The excerpt in Figure 18.2a is an early example. It maps out land along the Whanganui River into a blank region of unknown territory beyond the capital frontier. The rationality of the map is about access along the riverbanks and on the river itself, where the availability of water for use by settlers on their new properties made land attractive. Land is the central resource which, combined with water and access, attains use value. This is then translated into exchange value through the social performance of the map. Seen from an anthropological perspective, the map can be seen to reflect a culture of individuality and a social order governed by the institution of private ownership, without which the production of such a map would have been inconceivable. From the era of early settlement onwards, larger and larger areas were taken over first by the Crown through barter with Māori chiefs and then by private land holders through the sale of land from Crown holdings using maps of this kind. In this way territory was commodified and usufructuary rights alienated, transforming land from a simple resource into capital, which could be sold or rented out from owner to labourer.

In the concluding decades of the nineteenth century, mapping efforts progressed to encompass larger and larger tracts of land, and surveyors began to produce regional scale maps that divided the country into coordinated blocks for further subdivision (Figure 18.2b). Such maps provided a much needed context for land sales and the development of infrastructure across larger areas, and this became standard practice in the 1880s and onwards. Like the early survey maps, the information contained in the regional surveys was limited to features of critical importance for land sale and development, with special care given to the mapping of wetlands and rivers that could block and allow for access. The maps of this period illustrate how surveyors were attempting to provide more comprehensive outlines of territory on the ground, while trying to overcome the limited perspective available when drawing maps of a landscape portrayed from above. Ridges were often marked only with shadings designed to indicate where difficult terrain had stopped the map maker from exploring further, and road plans given on the maps were like snakes of detailed measurements in territory which was otherwise unmeasured. Elevation information – which was critical to most road and land use planning – was only made available locally if needed, and even though such maps gave the impression of a bird's eye view of the land, they reflect a restricted perspective on a still largely unexplored but rapidly appropriated land mass.

During the first half of the twentieth century, map making in New Zealand expanded from its initial concern with resources and properties, to include a widening selection of physical landscape features. The introduction of aerial surveys in the 1920s offered a new perspective for map makers, and the perceived need for maps to be used by the armed

A. 1841, A cadastral map with topographical information



B. 1886, A topographic map with cadastral information

C. 1939, A military-topographic 'landscape' map

Figure 18.2 A hundred years of New Zealand map making. From an initial interest in commodification of land, it progressed to an interest in providing infrastructure and order, and climaxed with military maps to defend what had been gained. *Map A*: a survey of land titles detailing country sections laid out along the Whanganui River, by Kenneth Webster. *Map B*: an instructional example of how to design topographical maps by the Department of Lands and Survey. *Map C*: detail from the first sheet of the NZMS1 series.
Sources: Map A: excerpt from 'Plan of the country sections laid out on the Wanganui', 1841, MapColl-832.41gbbd/1841/Acc.15388, National Library of New Zealand Te Puna Mātauranga o Aotearoa; Map B: excerpt from 'A specimen plan of a portion of a section survey of a block', in *Regulations and Instructions of the Survey Department of New Zealand,* 3rd edn, Government Printer, Wellington, 1886; Map C: excerpt from 'Napier and Hastings', New Zealand Map Series 1, sheet N134, Department of Lands and Survey, Wellington, 1939

services in preparation for war spurred a growing interest in detailed topographical mapping. Plans were made for a comprehensive topographical survey of the entire country, and when the first sheet of the New Zealand Map Series (NZMS) was published in 1939 it marked the establishment of a map-making tradition which is still practised today (Figure 18.2c). The new maps provided spot heights and contour lines, depicting the surface of the earth as a continuous surface for the first time. They also contained information on the location and extent of all the groups of phenomena we would expect to find in a modern map: trees, shrubs, field divides, roads, buildings and water features, all draped across a well-defined surface. This was due to the fact that the topographic maps were made primarily for military purposes. They were designed in the context of pre-World War II fears of a Japanese invasion and were intended to supply the information needed for officers to direct regiments and artillery fire in combat situations.[25] As a consequence, they were also well suited for other planning and management purposes.

The first topographic map series was completed in 1975, when all of New Zealand had eventually been photographed from the air and stereoplotted to obtain contour line information. Since then the maps have been updated regularly in a number of subsequent topographical mapping schemes, which have changed only slightly since their introduction in the 1930s. They have come to represent a contemporary baseline understanding of the environment, which would have been alien to many surveyors in the nineteenth century, but which now seems rather ordinary. This is because the maps depict the landscape in ways that correspond with the spatial culture of contemporary society. As Jan Kelly has expressed it, the maps which form an active part of our spatial culture today are characterised by being 'ordinary maps, so explicable that the transition to "real" landscape becomes seamless in our minds and the symbols are as easily read as is a written language, or are seen as the living landscape itself'.[26] This cultural condition was developed over a prolonged period of time and has left its clear mark on the landscapes of New Zealand from the 1840s until today, given that many of them have not only been mapped but also moulded into shapes relevant to social understandings of the environment. The early maps of New Zealand, and the environments they depict, reflect a social order which was implemented spatially through European settlement and which was based on concepts and practices of capitalist production, individual freedom and private property rights.

Socioenvironmental expansion: from settlement to society

The combined subject matter of New Zealand maps has expanded over time and today map making is a tradition with as varied a content as most other art forms and sciences. New Zealand society has also changed dramatically and map-making efforts have reflected those changes, as well as changes in the environment. From the early navigational maps and surveys for settlement, to the topographic–military map making in the period between the wars and into the postwar period, when environmental management became a topic of interest to map makers, maps have reflected shifts in the ways in which society has understood its environment. These shifts can be represented

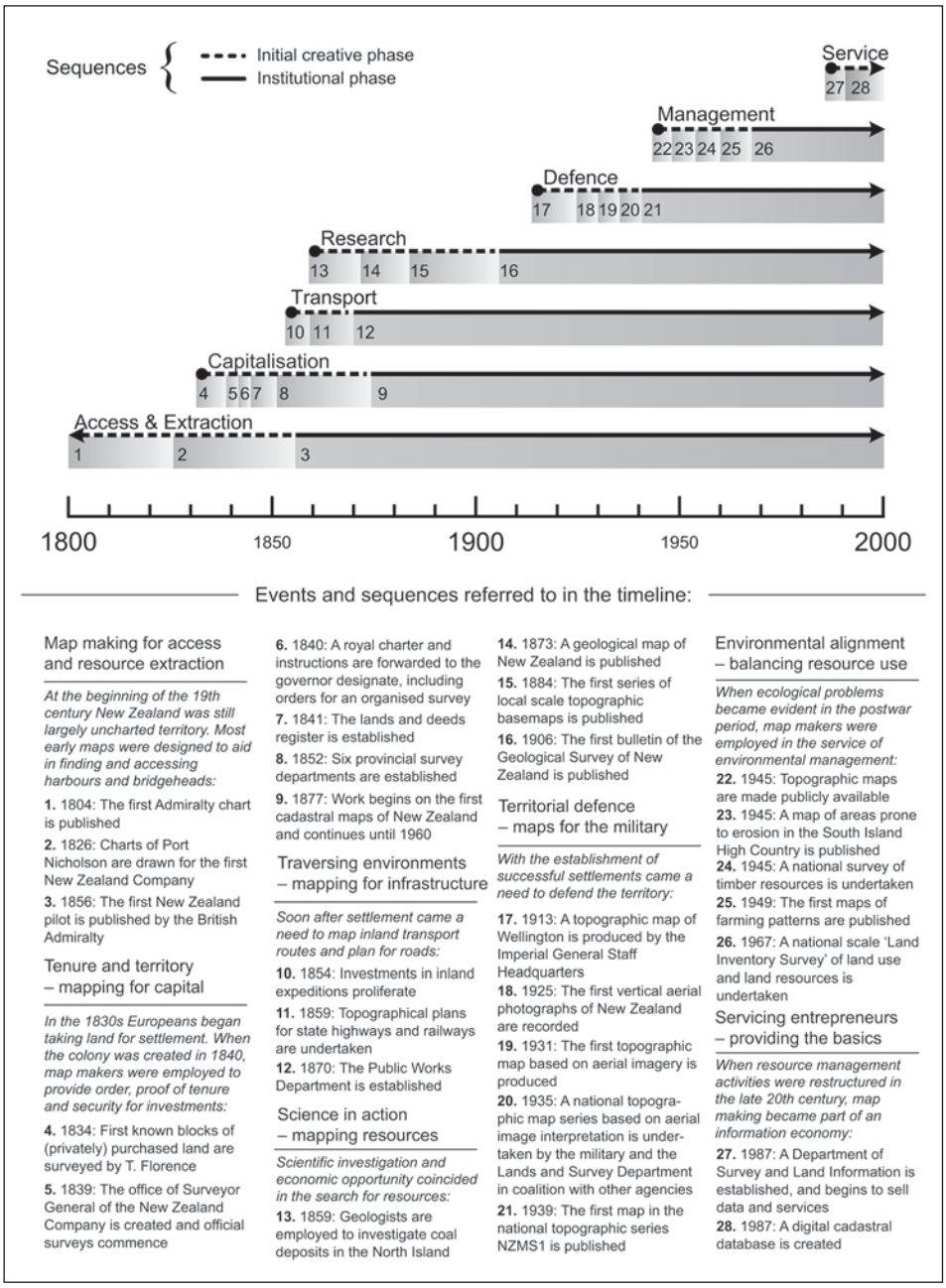


Figure 18.3 Key sequences in the production of geographical knowledge of New Zealand environments, 1800–2000. The reasons for mapping and measurement have changed over time, reflecting shifting societal needs. Only the seminal events in each novel map-making practice have been included. Source: based on information in Brian Marshall, ´From Sextants to Satellites: A Cartographic Timeline for New Zealand´, *New Zealand Map Society Journal*, no. 18, 2005, pp. 1–110

as key sequences in the production of geographical knowledge (Figure 18.3). The major topics of interest for mapping and measuring have been: (1) access, (2) capitalisation, (3) transport, (4) research, (5) defence, (6) management and (7) service. This sequence reflects the way New Zealand society has evolved over time, but is also testimony to a history of constantly expanding investment in environmental knowledge production, where phenomena included in map-making practices are never dropped or considered obsolete. This history is parallel in many ways to the sequence of ever-expanding claims placed on New Zealand environments by society, which allowed map-making practices to evolve from being a field-based local or regional endeavour to becoming a large-scale knowledge industry that exploded in the postwar period with the introduction of cheap aerial imagery.

Recording the environment in the service of the state

In 1923 the New Zealand government bought its first airplane fitted with a camera, and in 1936 the private company New Zealand Aerial Mapping (NZAM) was formed to supply government departments with spatial information. From then on aerial photography became an important part of the way New Zealand was mapped and understood, and NZAM became the major producer of aerial imagery in the country, both in respect of civil and military recordings.

In the years following its creation NZAM worked primarily for the Public Works Department, the Department of Scientific and Industrial Research and for individual farmers in need of imagery when conducting land improvements. Many of the early recordings were consequently of wetlands, coalfields and mineral deposits in peripheral areas of rural New Zealand. And in the same way the surveys and topographic maps of the preceding decades had led to changes in the environment, most of the environmental knowledge gained through aerial photography was used directly to change the environment through drainage projects, infrastructure development and resource extraction.

When war broke out in September 1939 such work was interrupted, and all aerial map-making efforts were directed towards the provision of maps for the army, which desperately needed new ones because the only available topographic maps were 'devoid of any but the main cultural features, being designed mainly for land boundary title purposes' (Figure 18.4).[27] The initial priority was to map the more densely populated North Island extensively, to map the important 'fortress areas' around the major cities which constituted key defensive terrain for the army, and to map aerodromes and training areas. A total of 177 map sheets at a scale 1:25.000 were completed on this contract, establishing NZAM as a close ally to the government departments involved in map-making activities.[28]

The peace of 1945 led to the demise of military investment in map making and the opening up of new markets consisting mainly of smaller clients interested in local or regional photomosaic surveys. As the director of NZAM put it, the postwar period was about '[producing] aerial survey maps in quantity, making them available at a rate which even the smaller local body will find reasonable'.[29] The transition to civil aerial

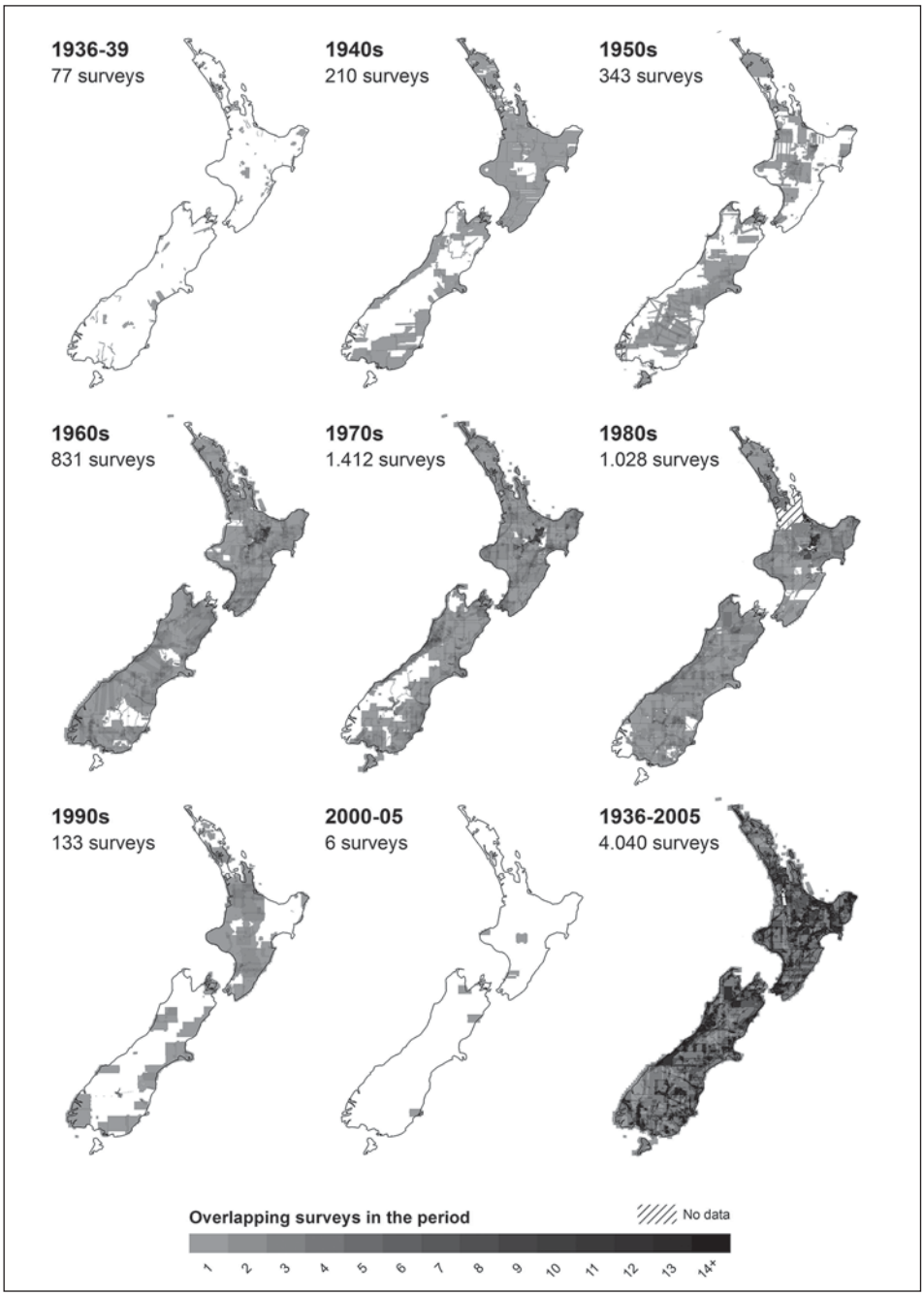


Figure 18.4 Recording New Zealand, 1930–2010. The geographic distribution and magnitude of aerial photography recorded for the New Zealand government for each decade from 1930 to 2010. Source: based on records of photography conducted by New Zealand Aerial Mapping for the New Zealand government, available from Land Information New Zealand (LINZ) at www.koordinates.com

Figure 18.5 Production systems under siege in the Wairarapa district, 1959. A countryside battle plan is in the making at a conference in Wellington in an attempt to stop the spread of hazardous organisms through the use of centralised systems of spatial intelligence.
Source: EP/1959/1566-F, National Library of New Zealand Te Puna Mātauranga o Aotearoa

photography turned out to be unproblematic, with numerous local government agencies interested in new coverage. Additional revenue was gained through the sale of archival images. These images became an asset from the late 1940s because it was possible for the first time to construct datasets containing time series of the same area, allowing for processes of environmental change to be mapped.

Local and national government interests in the environment had changed after the war and were now inclined towards a managerial approach to environmental knowledge production. Monitoring became increasingly important, while surveying and improvement efforts plateaued. This trend continued well into the 1980s with revenue figures for archival imagery sales 'edging ahead of income from flying commissions'.[30] Mapping efforts had reached a threshold. Most of the country had been explored and settled at great initial cost, with the creation of extensive agricultural, pastoral and silvicultural land use systems as a result. Spatial knowledge production efforts were beginning to shift

focus accordingly, to bring human-induced processes of environmental change into the crosshairs of map-making efforts. Such interests – spurred on by the declassification of many important data sources in 1945 – led to a continuous production of studies of processes of environmental degradation and hazards in the postwar period. Maps were increasingly used as management devices, for example as the basis for efforts to safeguard the biological economies of the countryside and monitor resource use (Figure 18.5). This continued for 40 years until the reform period of the late 1980s, when shifts in government emphasis completely changed how the environment was recorded and data made accessible.

Reform, privatisation and the information economy

In the late 1980s the government institutions responsible for producing and preserving spatial knowledge were restructured as part of a broad-ranging government reform that affected most departments, including those involved with environmental management. With the Survey Act of 1986 which came into effect on 1 April 1987, the mapping functions of the former Lands and Survey Department were moved into a new Department of Survey and Land Information (DOSLI): almost the same name as its predecessor, but with the significant addition of the word 'information'.[31] After a few years, DOSLI itself was replaced by another agency, Land Information New Zealand (LINZ). The word information in this context signified a new self-reflective stance in the vision for government map-making activities. It highlighted the transient and relational aspects of working with information rather than authoritative and objective knowledge per se, representing a new way of understanding knowledge.

Something similar occurred in most Western societies at about this time and had to do with cultural and technological developments that had grown in importance since the 1950s. The invention and spread of specialist computing systems after World War II and the development of information science as a discipline in the 1950s had seen the concept of information take on an increasingly important role both in academic contexts and in the wider public domain. Information in this sense was not understood to be synonymous with knowledge, or even with knowledge applied in the form of surveys and maps: information was knowledge communicated, denoting a process in which data reached a receiver who would then decipher the data into information. As Capurro and Hjørland put it 'information is not a pure observable, but a theoretical construct. It is "interpreted data".'[32] In this critical respect, regarding the difference between data, information and knowledge, the map-making paradigms of old were in conflict with the new culture and technology which were beginning to define society.

Until the late twentieth century the map had largely been considered an objective depiction of reality, its truthfulness thought to depend on the precision of its design and indirectly on the authority of its author.[33] With the 'information concept' of map making, map users in a way have been allowed into the backstage area of cartography. Access to raw spatial data in the form of computer-readable files became available to professionals and later to the wider public. Maps were not finished images any more, but pieces of

(objective) information stitched and collaged together by subjectively motivated map designers to meet their own specific requirements. This amounted to nothing less than a revolutionary liberalisation and decentralisation of shared topographic knowledge in New Zealand. One of the most significant events in this respect was the establishment of a digital cadastral database in 1987, which made it possible to access, edit, view and sell spatial economic data and data derivatives in a hitherto unseen flexible and decentralised way. The creation of a similar topographic database in 2002 led to comparable effects in the realm of topographical knowledge.

The neoliberal imperatives inherent in the reforms of the 1980s and 1990s went hand in hand with ideas of synergy, dynamic effects and growth, which were understood to be stimulated through competitive, objectively informed individual entrepreneurship, an ideal closely resembling the metaphor of the egotistically benevolent 'invisible hand' described by Adam Smith in his seminal work two centuries earlier.[34] In its 'Statement of Intent' published in 2012, LINZ made this plain when among its priorities the government mapping agency stated an intention to 'accelerate growth in the use of location-based information technologies by government and business as a key tool for growth and decision-making'.[35] With the application of ideas of this kind set in motion by the government reform of the 1980s, an information market had been set in place. These major changes, affecting most if not all public knowledge production regarding the environment, constituted a turning point in the history of New Zealand cartography and metrology and heralded a return to the liberal ideals of public management of the environment through support of private entrepreneurship, prevalent during the first European discovery of the country. It remains to be seen what the long-term effects of such policies will be.

Conclusion

Since the arrival of humans in the thirteenth century, the environmental history of New Zealand – with its myriad facets of human–environment interactions – has been closely intertwined with a parallel history of spatial knowledge production. The production of such knowledge can be construed as integral to the way human societies have attained power over the environments of New Zealand, in their continuous effort to attain sustenance and wealth. This was the case with Māori society, which developed from an initial state of transient resource consumption to settlement based on combinations of hunting, fishing and horticulture. This occurred through the development of usufructuary tenure institutions that were needed to stabilise a society based on contested spatially distributed resources. It was also the case when European settlers arrived approximately six hundred years later. They brought their own tenure institution and a set of technologies for spatial knowledge production with them, which led to drastic changes in both understandings and use of the environments of New Zealand.

Due to the eventual success of the European colonisers in subduing Māori resistance, the structure and disposition of the terrestrial environments of contemporary New Zealand is largely a result of interactions with the environments based on European

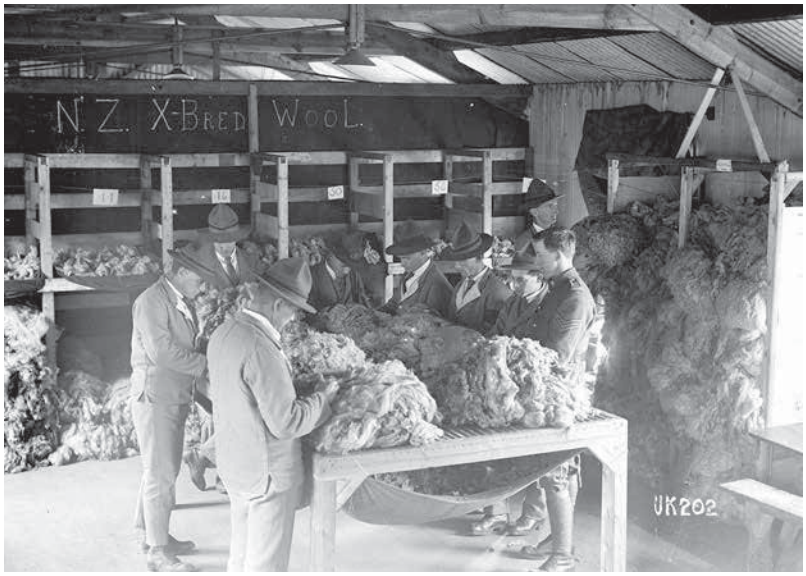


Figure 18.6

Top: Metrologies for decency, anno 1956. Even these young nursing students had to conform with objective measures for correct conduct, in this case embodied by the skirt-length measurement stick. Source: P/1956/1455/F, Alexander Turnbull Library collections, National Library of New Zealand Te Puna Mātauranga o Aotearoa

Bottom: Normalising the produce: wool classers at work with New Zealand wool, Hornchurch, England, during World War I. British quality paradigms, product standards and measuring technologies were widely applied in New Zealand to meet the expectations of export markets. Source: 1/2–013990-G, National Library of New Zealand Te Puna Mātauranga o Aotearoa

spatial culture and technology. The principal facet of such interactions was the particular idea of objectivity that was introduced through the application of devices and practices for measuring resources, products and properties. Metrics have since become such an integral part of modern society as to be all but invisible in terms of everyday practice (Figure 18.6). Historically their application was expressed most clearly in the way the settler economy appropriated and alienated space through surveying, defended it through mapping, and developed it through monitoring efforts. But as many of the previous chapters in this volume have illustrated, land was merely one among a wide range of resources to be measured, appropriated and ordered by way of European metrologies. For example, Jim McAloon has shown that the hunt for valuable kauri spars for shipbuilding – which led to the destruction of vast tracts of forest in the beginning of the nineteenth century – was motivated by a practice of measuring where 'the requirements were precise as to length, diameter, and taper, with one in ten thousand good enough for a mainmast'.[36] The same later became true for other commodities like New Zealand wool and meat, and indeed most other export products. Today these are ever more carefully measured to determine their value and secure access to export markets.[37] Such practices clearly illustrate how New Zealand resources and environments have been adapted historically to outside needs and specifications by way of metrological applications. The environmental history of New Zealand is in part a history of the application of such knowledge production practices, the culture and social order that supported it, and the environmental transformation that ensued.

Further reading

Little has been written about maps and metrologies in a New Zealand context. Russell Kirkpatrick's introduction to his *Bateman Contemporary Atlas of New Zealand: The Shape of Our Nation* (David Bateman, Auckland, 2nd edn, 2005) reflects on the history of map making, and Brian Marshall, 'From Sextants to Satellites: A Cartographic Timeline for New Zealand' (*New Zealand Map Society Journal*, no. 18, 2005, pp. 1–110) provides a lot of background information. *Te Ara – the Encyclopedia of New Zealand* contains a number of articles about surveying and map making, and Giselle Byrnes' book *Boundary Markers: Land Surveying and the Colonisation of New Zealand* (Bridget Williams Books, Wellington, 2001) provides a postcolonial critique of settler culture. In an international comparative context two publications should be mentioned: Roger J.P. Kain & Elizabeth Baigent, *The Cadastral Map in the Service of the State: A History of Property Mapping* (University of Chicago Press, Chicago, 1992), which contains a chapter on New Zealand; and Phillip Lionel Barton's chapter on 'Maori Cartography and the European Encounter' in David Woodward & G. Malcolm Lewis (eds), *The History of Cartography,* vol. 2, book 3 (University of Chicago Press, Chicago, 1998, pp. 493–532).

64 In 2005, 42 per cent of registered Ngāi Tahu lived within the tribal area compared to 45 per cent outside of it, and 7.5 per cent overseas: Stevens, 'Kāi Tahu me te Hopu Tītī ki Rakiura, p. 291.
65 Parsonson, 'Ngāi Tahu – The Whale That Awoke', p. 257.
66 www.whalewatch.co.nz
67 Tipene O'Regan, Guest Lecture, School of Business, University of Otago, 2002.
68 Te Maire Tau, 'Preface', in Tau & Anderson, *Ngāi Tahu: A Migration History*, p. 9.
69 Antoinette Burton, 'Introduction: The Unfinished Business of Colonial Modernities', in Antoinette Burton (ed.), *Gender, Sexuality and Colonial Modernities*, Routledge, London, 1999, p. 1.

18. Mastering the land: mapping and metrologies in Aotearoa New Zealand

1 For an analysis of the theoretical aspects of such notions of map making see John Pickles, *A History of Spaces. Cartographic Reason, Mapping and the Geo-coded World*, Routledge, London, 2004.
2 Atholl Anderson, 'A Fragile Plenty: Pre-European Maori and the New Zealand Environment', in Eric Pawson & Tom Brooking (eds), *Environmental Histories of New Zealand*, Oxford University Press, Melbourne, 2002, pp. 30–31.
3 Anderson, 'A Fragile Plenty', p. 33.
4 Evelyn Stokes, 'Contesting Resources: Māori, Pākehā, and a Tenurial Revolution', in Pawson and Brooking (eds), *Environmental Histories*, p. 36.
5 Stokes, 'Contesting Resources', p. 36.
6 Ibid., p. 35.
7 Jan Kelly, 'Maori Maps', *Cartographica*, vol. 36, no. 2, 1999, pp. 12–13.
8 Danny Keenan, 'Bound to the Land: Māori Retention and Assertion of Land and Identity', in in Pawson and Brooking (eds), *Environmental Histories*, p. 250.
9 Kelly, 'Maori Maps', p. 15.
10 Mere Roberts, 'Mind Maps of the Maori', *GeoJournal*, vol. 77, no. 6, 2012, pp 741–51.
11 While an unknown southern continent had been hypothesised among European scholars and included on world maps since antiquity, the first known map to show a coast at approximately the location of New Zealand is the Dieppe map drawn by Jean Rotz and presented to King Henry VIII of England c. 1535–42. Numerous later maps of the same tradition repeat and elaborate on the coastline in the southern ocean drawn by Rotz.
12 William Grent, *A New and Accurate Map of the World Drawne According to the Truest Descriptions, Latest Discoveries, and Best Observations, that Have Been Made by English, or Strangers*, London, 1625.
13 Jeppe Strandsbjerg, 'The Cartographic Reality of Space. Territory, Globalisation and International Relations', PhD thesis, University of Sussex, 2008.
14 Roger J.P. Kain & Elizabeth Baigent, *The Cadastral Map in the Service of the State: A History of Property Mapping*, University of Chicago Press, Chicago, 1992, pp. 318–25.
15 John Brian Harley, 'Deconstructing the Map', *Cartographica*, vol. 26, no. 2, 1989, pp. 1–20.
16 Brian Marshall, 'From Sextants to Satellites: A Cartographic Timeline for New Zealand', *New Zealand Map Society Journal*, no. 18, 2005, p. 104.
17 Phillip Lionel Barton, 'Maori Cartography and the European Encounter', in David Woodward & G. Malcolm Lewis (eds), *The History of Cartography*, vol. 2, book 3, University of Chicago Press, Chicago, 1998, pp. 493–532.
18 Kelly, 'Maori Maps', pp. 4, 11.
19 Bruno Latour, *Politics of Nature: How to Bring the Sciences into Democracy*, Harvard University Press, Cambridge, MA and London, 2004, pp. 15–18.
20 Latour, *Politics of Nature*, p. 10.
21 Kelly, 'Maori Maps', p. 15.
22 Stokes, 'Contesting Resources'; Keenan, 'Bound to the Land'.
23 Jim McAloon, 'Resource Frontiers, Environment and Settler Capitalism 1769–1860', in Pawson and Brooking (eds), *Environmental Histories*, p. 52.
24 Cited in Marshall, 'From Sextants to Satellites', p. 36.
25 Jeremy Black, *War in the Modern World Since 1815*, Routledge, London, 2003, p. 16.
26 Kelly, 'Maori Maps', pp. 1–2.
27 Geoff Conly, *Piets Eye in the Sky. The Story of New Zealand Aerial Mapping Ltd.*, Grantham House, Wellington, 1986, p. 71.

28 Conly, *Piets Eye,* p. 81.
29 Piet van Asch, in *Whites Aviation Magazine*, vol. 1, 1945, cited in Conly, *Piets Eye*, p. 95.
30 Conly, *Piets Eye*, p. 97.
31 Marshall, 'From Sextants to Satellites', p. 97.
32 Rafael Capurro & Birger Hjørland, 'The Concept of Information', *Annual Review of Information Science and Technology*, vol. 37, no. 1, 2003, pp. 343–411.
33 Chris Perkins, 'Cartography: Mapping Theory', *Progress in Human Geography,* vol. 27, no. 3, 2003, pp. 341–51.
34 Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations: A Selected Edition*, Oxford Paperbacks, Oxford, 2008 (first published 1776).
35 Land Information New Zealand Toitu Te Whenua, *Statement of Intent 2012–2015*, New Zealand Government, Wellington, 2012, p. 4.
36 McAloon, 'Resource Frontiers', p. 59.
37 Peter Swann, *The Economics of Metrology and Measurement*, Report for the National Measurement Office, Department of Business, Innovation and Skills, Wellington, 2009, pp. i–ix.

19. Epilogue

1 We are grateful to Peter Holland, Harvey Perkins and Vaughan Wood for discussions during the preparation of this Epilogue, although we alone are responsible for the final result.
2 C.P. Snow, *The Two Cultures*, Cambridge University Press, Cambridge, 1993. In this edition, Stefan Collini, in the 'Introduction', argues that the nature of academic disciplines and changes since the late 1950s 'have made any binary division into *two* cultures look more implausible than ever' (p. lv). Whether this makes it any easier for conversations to occur between those in the humanities and those in sciences is another matter.
3 Tom Griffiths, 'We Have Still Not Lived Long Enough', *Inside Story*, 16 February 2009, http://inside.org.au/we-have-still-not-lived-long-enough/; Eric Pawson, 'Environmental Hazards and Natural Disasters', *New Zealand Geographer*, vol. 67, no. 3, 2011, pp. 143–47.
4 A useful collection of essays that engages with this theme is Kimberly Coulter & Christof Mauch (eds), *The Future of Environmental History: Needs and Opportunities*, Rachel Carson Center Perspectives, issue 3, Munich, 2011.
5 Sverker Sörlin & Paul Warde, 'The Problem of the Problem of Environmental History: A Re-Reading of the Field', *Environmental History*, vol. 12, no. 1, 2007, p. 118.
6 B.B. Fitzharris, 'The 1992 Electricity Crisis and the Role of Climate and Hydrology', *New Zealand Geographer*, vol. 48, no. 2, 1992, pp. 79–83; Peter Holland & Bill Mooney, 'Wind and Water: Environmental Learning in Early Colonial New Zealand', *New Zealand Geographer*, vol. 62, no. 1, 2006, pp. 39–49.
7 E.T.J. Durie, *New Approaches to Maori Land in the 1980's with Particular Reference to Its Settlement and Resettlement in the Northern Half of the North Island*, Auckland Branch, New Zealand Geographical Society, Auckland, 1981; and Stephen Dovers, *Environmental History and Policy: Still Settling Australia*, Oxford University Press, Melbourne, 2000.
8 Land and Water Forum, *Third Report of the Land and Water Forum: Managing Water Quality and Allocating Water,* Land and Water Trust, 2012, www.landandwater.org.nz.
9 Paul James & Eric Pawson, 'Contested Places: The Significance of the Motunui-Waitara Claim to the Waitangi Tribunal', *Aboriginal History*, vol. 19, 1995, 111–25; Nicola R. Wheen & Jacinta Ruru, 'The Environmental Reports', in Janine Hayward & Nicola R. Wheen (eds), *The Waitangi Tribunal/Te Roopu Whakamana i te Tiriti o Waitangi*, Bridget Williams Books, Wellington, 2004, pp. 97–112.
10 Ministry for the Environment, 'Recreational Water Quality in New Zealand', *Indicator Update,* INFO 653, 2012.
11 Eric Pawson, 'Kenneth Cumberland 1913–2011', in Hayden Lorimer & Charles W.J. Withers (eds), *Geographers Biobibliographical Studies*, vol. 31, Commission on the History of Geography of the International Geographical Union and the International Union of the History and Philosophy of Science, Continuum International Publishing Group, London, 2012, pp. 137–60.
12 Marianne Elisabeth Lien & John Law, '"Emergent Aliens": On Salmon, Nature, and Their Enactment', *Ethnos, Journal of Anthropology*, vol. 76, no. 1, 2011, p. 83.
13 William Cronon, 'The Trouble with Wilderness; or, Getting Back to the Wrong Nature', in William Cronon (ed.), *Uncommon Ground: Toward Reinventing Nature*, W.W. Norton, New York, 1995, pp. 69–90; Mick Abbott & Richard Reeve (eds), *Wild Heart: The Possibility of Wilderness in Aotearoa New Zealand*, Otago University Press, Dunedin, 2011.