

1. INTRODUCTION

This chapter provides an introduction to my thesis and contains an overview of the extent of the Great Barrier Reef, some definitions of that ecosystem and the rationale for my study. Several reports of decline in the Great Barrier Reef are presented below; these reports indicate that environmental changes have occurred in the ecosystem as a result of human activities in the Great Barrier Reef and on the adjacent coastal land. My research provides evidence of some of these changes, based on qualitative sources including archival documents and oral histories; my aims, objectives and research questions are stated below, and the scope and limitations of my research are outlined. The chapter concludes with a brief outline of the thesis.

1. INTRODUCTION

1.1 The Great Barrier Reef of Australia

The Great Barrier Reef of Australia is the largest complex of coral reefs and associated species on Earth; the location of this structure is shown in Figure 1.1. The ecosystem extends for over 2,000 kilometres along the north-eastern coast of Australia, containing more than 3,200 coral reefs and representing one of the most biologically diverse ecosystems known to exist.¹ The Great Barrier Reef is a young structure in geological terms, having formed during the last 10,000 years of the Holocene epoch; its reefs have always existed in relation to humans, supporting coastal Indigenous subsistence economies and containing many places of cultural and spiritual significance.² After European settlement in Australia, the ecosystem influenced the colonial development of Queensland and was subjected to more intensive exploitation, especially since 1900.

Yet the significance of the Great Barrier Reef extends beyond Australia. The coral reefs and their associated species were first protected by the creation of the Great Barrier Reef Marine Park (GBRMP) in 1975. More recently, in 1981, the United Nations Educational, Scientific and Cultural Organization (UNESCO) acknowledged the outstanding universal value of the ecosystem as a natural phenomenon of global significance by creating the Great Barrier Reef World Heritage Area (GBRWHA).³ The extent of the GBRWHA, shown in Figure 1.2, is approximately 347,850 km², forming the largest World Heritage Area in the world. The Great Barrier Reef Marine Park Authority (GBRMPA), the lead agency responsible for the management and conservation of the GBRWHA, has faced unprecedented challenges in managing multiple human uses, activities and impacts in the GBRWHA.⁴

¹ J. Bowen and M. Bowen, *The Great Barrier Reef: history, science, heritage*, Cambridge University Press, Cambridge, 2002, p. 2.

² Bowen and Bowen, *Great Barrier Reef*, p. 3; D. Hopley, *The Great Barrier Reef: ecology and management*, Longman Cheshire, Melbourne, 1989, p. 19.

³ P. H. C. Lucas *et al.*, *The outstanding universal value of the Great Barrier Reef World Heritage Area*, GBRMPA, Townsville, 1997, p. 3.

⁴ D. R. Wachenfeld *et al.* (eds), *State of the Great Barrier Reef World Heritage Area 1998*, GBRMPA, Townsville, 1998, p. 5; see also M. Furnas, *Catchments and corals: terrestrial runoff to the Great Barrier Reef*, AIMS, Townsville, 2003, p. 21; D. Lawrence *et al.*, *The Great Barrier Reef: finding the right balance*, Melbourne University Press, Carlton South, Victoria, 2002.

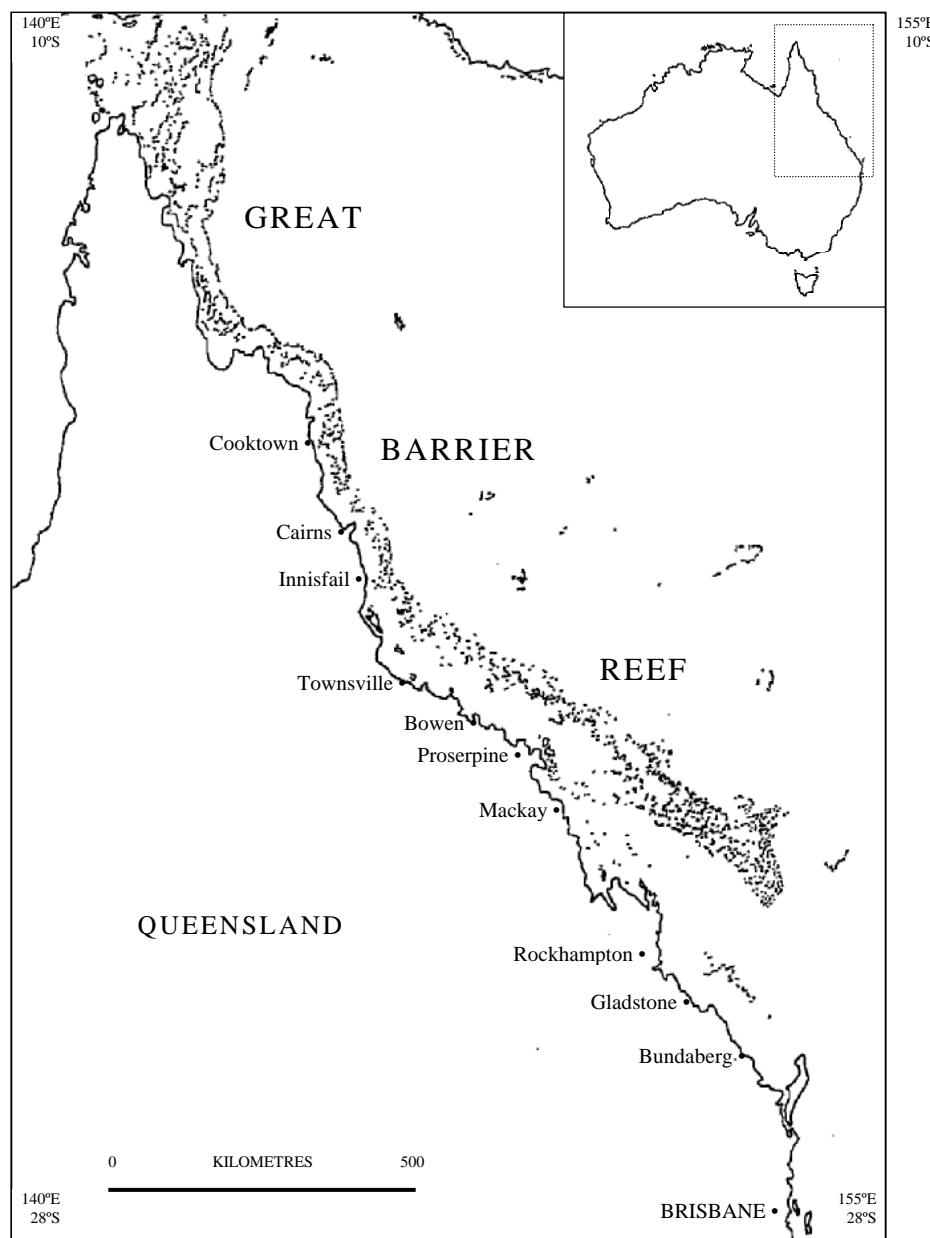


Figure 1.1. The geographical extent of the Great Barrier Reef.

Source: Based on Wachenfeld *et al.* (eds), *State of the GBRWHA*, p. 4.

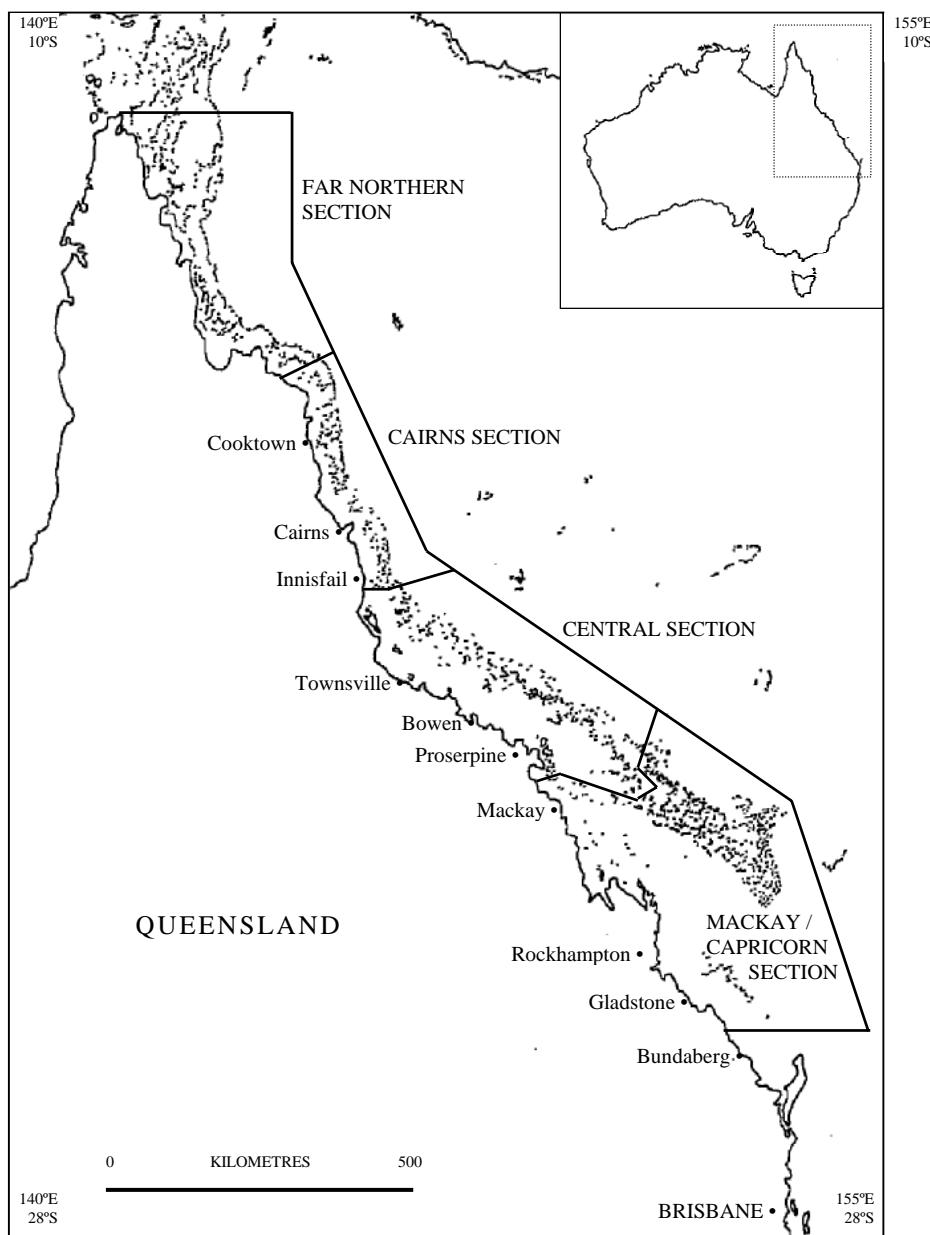


Figure 1.2. The geographical extent of the GBRWHA.

Source: Based on Wachenfeld *et al.* (eds), *State of the GBRWHA*, p. 4.

The Great Barrier Reef has been defined in various ways since Matthew Flinders first used that term in 1802; Maxwell listed several of those definitions in his *Atlas of the Great Barrier Reef*.⁵ ‘Great Barrier Reef Province’ refers to the coral reefs of eastern Australia and Torres Strait: one of seven coral reef provinces in the south-western Pacific Ocean. ‘Great Barrier Reef Region’ describes the first Australian coral reef area to be legally protected; in 1975, that term was replaced by the GBRMP, which extends northwards as far as the latitude of Cape York but excludes the coral reefs of Torres Strait. The GBRWHA, shown in Figure 1.2, occupies approximately the same area as the GBRMP, although variations exist in their coastal boundaries; the GBRWHA also includes the islands of the Great Barrier Reef, while the GBRMP consists of the marine environment alone.⁶ All of these terms are found in the scientific literature of the Great Barrier Reef, reflecting the problem of defining a vast, complex ecosystem. My research focuses principally on the GBRWHA, as this is the area for which the GBRMPA bears most stringent management responsibilities, and because archival and oral history sources contain evidence of changes in islands. Yet most historical sources predate the definition of the GBRWHA and often use the general term, ‘Great Barrier Reef’.

Conceptions of the Great Barrier Reef held by Indigenous people differ significantly from those of non-Indigenous Australians. Many Indigenous people regard the Great Barrier Reef as sacred and its importance is reflected in creation stories. Some species, including dugongs and turtles, have formed – and continue to form – a vital part of the cultural identity of coastal Indigenous people; for such people, the Great Barrier Reef forms part of traditional ‘sea country’. Human use of the GBRWHA raises issues of self-determination, participation and co-management of resources by Indigenous people. Recently, scholars using postcolonial approaches have produced new interpretations of colonisation in Australia, developing new narratives of contact and resistance, and suggesting that no single account of the environmental history of the Great Barrier Reef is adequate.⁷

⁵ J. Bowen, ‘The Great Barrier Reef: towards conservation and management’, in S. Dovers (ed), *Australian environmental history: essays and cases*, Oxford University Press, Melbourne, 1994, pp. 234-256, p. 235; W. G. H. Maxwell, *Atlas of the Great Barrier Reef*, Elsevier, Amsterdam, 1968.

⁶ For further details of these definitions, see Lucas *et al.*, *Outstanding universal value*, pp. 36-37 and 99.

⁷ D. Smyth, *Understanding country: the importance of land and sea in Aboriginal and Torres Strait Islander societies*, Key Issue Paper No. 1, Council for Aboriginal Reconciliation, AGPS, Canberra, 1994, p. 2; postcolonial works include N. Loos, *Invasion and resistance: Aboriginal-European relations on the North Queensland frontier, 1861-1897*, ANU Press, Canberra, 1982; J. M. Jacobs, *Edge of empire: postcolonialism and the city*, Routledge, London, 1996.

However the Great Barrier Reef is defined, the ecosystem does not exist independently of adjacent environments. A recent study of terrestrial runoff to the Great Barrier Reef, by Furnas, acknowledged that the GBRWHA is interconnected with its sources of freshwater, sediments and nutrients: in particular, with the 35 drainage basins of Queensland that form the Great Barrier Reef Catchment Area (GBRCA).⁸ The GBRCA includes around 25 per cent of the land area of Queensland and run-off from this area represents a major input to the GBRWHA. Therefore, the GBRWHA and the GBRCA, shown in Figure 1.3, form a functional unit; accounts of environmental changes in the GBRWHA should consider impacts that originate in the GBRCA. Significant land uses in the latter include rangeland cattle grazing, forestry, sugar cane farming, cultivation of bananas and other tropical fruits, aquaculture and mining. In addition, urban development has taken place rapidly in the GBRCA; from 1991-1998, an average annual population growth rate of 2.2 per cent resulted in over one million people living in the GBRCA by the latter date.⁹ Economic development in Queensland has been promoted by the growth of tourism in the GBRWHA, which now comprises more than one million visitor days, and in excess of A\$1 billion, each year. Consequently, the condition of the Great Barrier Reef is of considerable economic and social importance.

1.2 Rationale: the decline of the Great Barrier Reef?

Many recent reports have suggested that the condition of the Great Barrier Reef has declined since European settlement commenced, as a result of exploitation and the development of adjacent coastal land; some of the most significant of these reports are listed in Table 1.1.¹⁰ Their authors have acknowledged that terrestrial run-off of

⁸ Furnas, *Catchments and corals*, pp. 41 and 46.

⁹ Furnas, *Catchments and corals*, p. 65.

¹⁰ QEPA (Queensland Environmental Protection Agency), *State of the environment Queensland 1999*, QEPA, Brisbane, 1999, pp. 5.4, 5.13 and 5.27; C. Wilkinson (ed), *Status of coral reefs of the world: 2000*, AIMS, Townsville, 2000; J. B. C. Jackson *et al.*, ‘Historical overfishing and the recent collapse of coastal ecosystems’, *Science*, Vol. 293, 27 July 2001, pp. 629-638; D. McB. Williams, *Impacts of terrestrial run-off on the Great Barrier Reef World Heritage Area*, Report to CRC Reef, CRC Reef Research Centre, Townsville, 2001, pp. 3-4; C. Dennis, ‘Reefs under threat from ‘bleaching’ outbreak’, *Nature*, Vol. 415, 28 February 2002, p. 947; D. McB. Williams *et al.*, *The current level of scientific understanding on impacts of terrestrial run-off on the Great Barrier Reef World Heritage Area*, Consensus Statement, CRC Reef Research Centre, Townsville, 2002, p. 1; Science Panel 2003, *A report on the study of land-sourced pollutants and their impacts on water quality in and adjacent to the Great Barrier Reef*, viewed 30 January 2003, <<http://www.premiers.qld.gov.au/about/reefwater.pdf>>; Commonwealth of Australia, Productivity Commission, *Industries, land use and water quality in the Great Barrier Reef catchment*, Research Report, Commonwealth of Australia, Productivity Commission, Canberra, 2003.

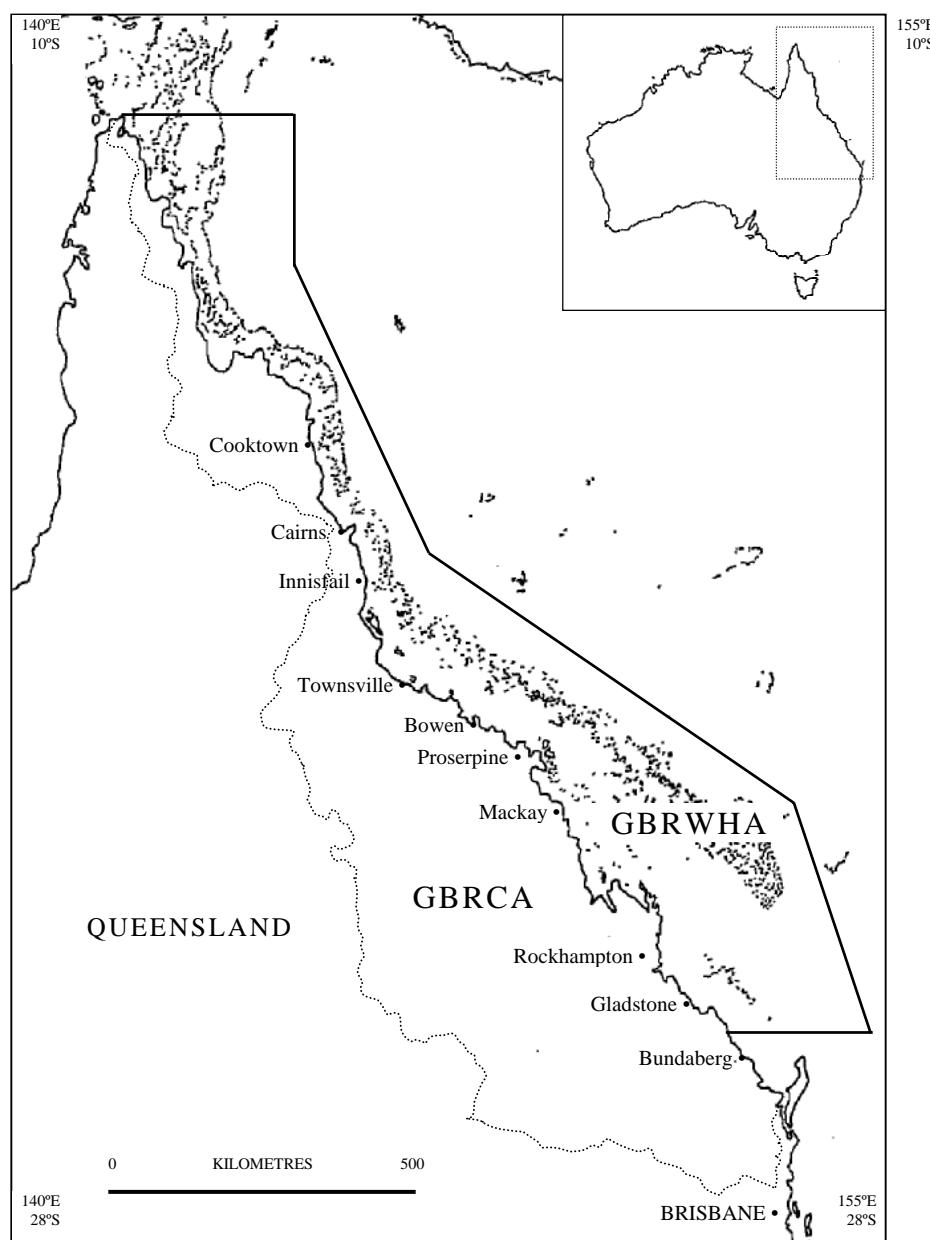


Figure 1.3. The geographical extent of the GBRWHA and the GBRCA.

Source: Based on Furnas, *Catchments and corals*, p. 2.

QEPA (Queensland Environmental Protection Agency) (1999)

'The Great Barrier Reef lagoon is particularly susceptible to the effects of nutrient enrichment due to its relatively enclosed and shallow nature. Nutrient inputs to the lagoon have increased substantially over past decades as a result of extensive land clearing and catchment development.' (QEPA 1999, p. 5.4)

This report identified many impacts in the coastal zone of Queensland, including extensive land clearing and coastal run-off. The QEPA (1999, p. 5.13) reported the depletion of species at Langford, Heron, North-West, Tryon and Lady Musgrave reefs, and near Dingo, Four Mile and Kurrimine Beaches, due to over-collection. The report claimed that particular damage has been caused by commercial and recreational shell collecting, commercial coral collecting, aquarium fish collecting and bêche-de-mer collecting (QEPA 1999, p. 5.27).

Williams (2001)

'There is currently significant cause for concern for the impacts of terrestrial run-off on nearshore coral reefs, seagrasses [...] and estuaries and rivers [...] in the Great Barrier Reef World Heritage Area. These impacts are a result of both past and present land use practices.' (Williams 2001, p. 3)

Williams (2001, p. 1) considered impacts of nutrient and sediment run-off on the Great Barrier Reef and argued that the consequent decline in water quality may be the most important single environmental threat to the coral reefs and associated species. The report claimed that sediment discharges have increased by three or four times, nitrogen discharges have doubled, and phosphorous quantities have increased by six to ten times since 1800; as a result, Williams (2001, pp. 3-4) advocated a precautionary approach to the management of nearshore reefs.

Williams et al. (2002)

'Run-off of sediments and nutrients to the Great Barrier Reef has increased several-fold as a result of past and current land-use practices. There is significant concern that coastal ecosystems in the Great Barrier Reef World Heritage Area [...] are being adversely affected as a consequence of this increase.' (Williams et al. 2002, p. 1)

This report represents a consensus statement by CRC Reef scientists about the impacts of terrestrial run-off on the Great Barrier Reef; the authors stated that the impacts of coastal run-off are most significant for nearshore reefs and seagrass beds within 20 kilometres of the coast, south of Port Douglas. The report claims that the most severely impacted areas lie between Port Douglas and Hinchinbrook Island, and between Bowen and Mackay.

Commonwealth of Australia, Productivity Commission (2003)

'There is now clear evidence of an increase in sediment and nutrients entering the GBR lagoon since European settlement.' (Commonwealth of Australia, Productivity Commission 2003, p. xxviii)

This report acknowledged the decline in water quality in the Great Barrier Reef lagoon as a result of sediments, nutrients and chemicals from agricultural and pastoral land; the report also argued that cattle grazing and crop production are the most important sources of pollution into the Great Barrier Reef lagoon (Commonwealth of Australia, Productivity Commission 2003, pp. xxii and xxix). As a result, the Productivity Commission stated that corals, seagrasses and fish populations may have declined. The impacts of pollution, these authors argued, are greatest on inner coral reefs between Port Douglas and Hinchinbrook Island, and between Mackay and the Whitsunday Islands (Commonwealth of Australia, Productivity Commission 2003, pp. 37 and 42).

Science Panel (Great Barrier Reef Protection Interdepartmental Committee Science Panel) (2003)

'The Panel found that there are clear indications that major land use practices in the river catchments, delivering waters to the Reef, have led to accelerated erosion and greatly increased the delivery of nutrients to over pre-1850 levels. [...] The Panel found that there is clear evidence of the effect of these activities on some rivers, estuaries and inshore areas. Reefs at a number of inshore locations along the coast have been disturbed and remain in a disturbed state. These reefs exhibit characteristics consistent with altered ecological function due to enhanced nutrient availability or sedimentation.' (Science Panel 2003, p. 9)

The Queensland Government Science Panel (2003, p. 2) stated that some areas of the Great Barrier Reef, those 'most affected by river run-off, appear to be degraded and/or slow to recover from natural events, such as cyclones.' The Science Panel found that at least a four-fold increase in sediment and nutrient discharges from coastal rivers to the GBRWHA has occurred during the evolution of the Queensland coast as a result of grazing, agriculture, vegetation clearance and drainage on adjacent coastal land (Science Panel 2003, pp. 12-13).

Table 1.1. Some recent reports of environmental decline in the Great Barrier Reef.

sediments, nutrients and other pollutants threatens the Great Barrier Reef and may have degraded inshore coral reefs and seagrass communities. Other studies have indicated that the Great Barrier Reef has deteriorated since 1990 as a result of coral bleaching.¹¹ In addition to these scientific accounts, anecdotal reports of decline in the Great Barrier Reef exist, attributing the degradation of coral reefs and other species to many human impacts: shipping, marine pollution, sediment and nutrient run-off, habitat destruction, coastal development, fishing and the collection of marine specimens.¹² The degradation of the Great Barrier Reef is thought by some observers to have occurred – or to have worsened – since European settlement; the most severe degradation is thought to have affected the inshore habitats in the most accessible parts of the GBRWHA: in the Cairns, Townsville and Whitsunday regions, which have experienced intensive human use and substantial terrestrial run-off. The GBRMPA is under increasing pressure to confirm or to refute these anecdotal reports of decline in the Great Barrier Reef.

However, extensive scientific monitoring of the Great Barrier Reef took place only after 1970, and scarce scientific data exist for the earlier period. Therefore, anecdotal claims that the ecosystem has declined cannot be assessed using existing scientific baselines; instead, qualitative sources can provide valuable evidence of changes in the Great Barrier Reef for the period before extensive scientific monitoring began. Many qualitative sources, including documentary and oral history materials, provide evidence of the condition of the Great Barrier Reef at specific locations and at various times in the past; oral history, in particular, has been little used to investigate changes in coral reefs, islands and marine wildlife. My research used an array of qualitative sources to investigate these environmental changes and to produce three environmental history narratives. I used qualitative interviewing to collect oral histories from informants who have observed environmental changes in the Great Barrier Reef; those oral histories were used to complement materials collected from Australian archives and libraries. In addition to presenting this evidence, I have also evaluated the potential of qualitative methods for environmental history research, and I have suggested several implications of my research for the contemporary management of the GBRWHA.

¹¹ O. Hoegh-Guldberg 1999, *Climate change, coral bleaching, and the future of the world's coral reefs*, viewed 2 October 2003, <http://www.greenpeace.org.au/climate/pdfs/coral_report.pdf>; J. M. Lough, *Sea surface temperatures on the Great Barrier Reef: a contribution to the study of coral bleaching*, Research Publication No. 57, GBRMPA, Townsville, 1999.

¹² Lucas *et al.*, *Outstanding universal value*, pp. 65-66.

My research is an environmental history study: it is concerned with the changing relationship between the Great Barrier Reef and human activities since 1860. Within the academic sub-discipline of environmental history, Australian studies comprise a small subset and most have focused on the terrestrial themes of forests, soils and agriculture. Many works have described environments in southern Australia, and many other parts of the country have been neglected. Environmental histories of the Great Barrier Reef are rare; two recent works exist, but neither made extensive use of archival records or oral histories.¹³ My research uses Cronon's approach to environmental history, which treats environmental history as the production of a narrative and which acknowledges the role of the narrator in telling a story about environmental changes; such an approach acknowledges that perceptions of environmental changes reflect the diverse views of individuals in specific communities.¹⁴ Therefore, in my research, I have considered issues of subjectivity and bias in the collection and interpretation of qualitative materials, including the value-laden, interpretive nature of oral history sources.

My study is distinctive in its use of qualitative sources – especially oral histories – to investigate changes in a marine environment; it differs from the many scientific studies of the ecology, biology and geology of the Great Barrier Reef both in its philosophical approach and in its methodology. My methodology is based on the approach by Denzin and Lincoln, who defined qualitative research as ‘a situated activity that locates the observer in the world.’¹⁵ Those authors argued that qualitative research is a distinct field of academic inquiry that is concerned with the interpretation of empirical materials in order to produce representations, such as recordings and texts; consequently, the outcome of qualitative research is itself an interpretation of reality. In common with Cronon’s approach to environmental history, that of Denzin and Lincoln to qualitative research emphasises the critical position of the researcher, because the researcher’s own values and attitudes influence the research process. Therefore, these two approaches are complementary: both use postmodern critical theory, examine the role of the narrator/researcher, and consider the social and political contexts of representation.

¹³ Bowen, ‘Great Barrier Reef’; Bowen and Bowen, *Great Barrier Reef*.

¹⁴ W. Cronon, ‘A place for stories: nature, history and narrative’, *Journal of American History*, Vol. 78, 1992, pp. 1347-1376.

¹⁵ N. K. Denzin and Y. S. Lincoln, ‘Introduction: the discipline and practice of qualitative research’, in N. K. Denzin and Y. S. Lincoln (eds), *Handbook of qualitative research*, 2nd edn, Sage Publications, Thousand Oaks, California, 2000, pp. 1-28, p. 3.

In contrast, some environmental historians have attempted to reconstruct past environments in order to derive baselines that can be used to assess environmental changes.¹⁶ Such reconstructions of the condition of the Great Barrier Reef at the time of European settlement – if possible to produce – could reveal subsequent changes in coral reefs, islands and marine wildlife. Some authors have attempted to establish this type of baseline using historical sources; Wachenfeld, for example, has compared historical photographs of specific coral reefs in the Great Barrier Reef with modern images in order to reconstruct environmental changes, although he acknowledged that many methodological difficulties hinder the use of historical photographs in reconstructing changes in coral reefs.¹⁷ In general, any attempt to reconstruct ecological baselines for the Great Barrier Reef is problematic since historical records are incomplete and scant scientific monitoring of the Great Barrier Reef took place before 1970. Any attempt to reconstruct ecological baselines is also challenged by the postmodern view that all representations of reality are interpretive and value-laden: they do not record objective realities. Therefore, my narrative of environmental changes in the Great Barrier Reef is not definitive but represents one possible reading of the historical evidence.

Although it may be impossible to reconstruct, definitively, the pre-European state of the Great Barrier Reef, it is possible to write an environmental history narrative of changes in this ecosystem; for, as Steven Dovers has argued, there are ‘good stories’ to be told about the ways in which humans have interacted with their environment.¹⁸ The collection of oral histories of the Great Barrier Reef is valuable because, in conjunction with other qualitative sources, these can form the basis of a ‘convincing non-fiction’ about the Great Barrier Reef that includes the perspectives of coral collectors, shell collectors, boat operators, fishers, farmers, divers, scientists, geomorphologists and environmental managers.¹⁹ Despite postmodern claims about the impossibility of

¹⁶ S. Dovers, ‘Australian environmental history: introduction, review and principles’, in S. Dovers (ed), *Australian environmental history: essays and cases*, Oxford University Press, Melbourne, 1994, pp. 2-19; B. Gammage, ‘Sustainable damage: the environment and the future’, in S. Dovers (ed), *Australian environmental history: essays and cases*, Oxford University Press, Melbourne, 1994, pp. 258-267.

¹⁷ D. R. Wachenfeld, ‘Report of the Historical Photographs Project of the Great Barrier Reef Marine Park Authority’, Unpublished Report to the GBRMPA, GBRMPA, Townsville, 1995; D. R. Wachenfeld, ‘Long-term trends in the status of coral reef-flat benthos: the use of historical photographs’, in D. R. Wachenfeld *et al.* (eds), *State of the Great Barrier Reef World Heritage Area Workshop: proceedings of a technical workshop held in Townsville, Queensland, Australia, 27-29 November 1995*, Workshop Series No. 23, GBRMPA, Townsville, 1997, pp. 134-148.

¹⁸ Dovers, ‘Australian environmental history’, p. 4.

¹⁹ Cronon, ‘A place for stories’, p. 1373.

reconstructing past environments, such environmental histories are necessary in order to provide rich, contextual descriptions of changes in the Great Barrier Reef. My account attempts to locate human activities within a context of changing environmental conditions, to allow an evaluation of human impacts to be made, and to illuminate the changing relationship between human societies and the Great Barrier Reef. In addition, in evaluating the potential value of qualitative sources in environmental history research, and in deriving several implications for the contemporary management of the GBRWHA, my research crosses disciplinary boundaries and addresses the concerns of both academic researchers and environmental managers; some tensions inevitably arise in such a process.²⁰ Nonetheless, interdisciplinary work of this kind offers fresh insights into the changing relationship between humans and the Great Barrier Reef since European settlement, and into the consequent environmental changes.

1.3 Aims, research questions and outcomes

The aims of my research are:

- a) to use an array of qualitative methods, including archival searches and oral history interviews, to document changes in the coral reefs, islands and marine wildlife of the Great Barrier Reef;
- b) to interpret the significance of environmental changes in the context of European settlement and the use of the region and of the adjacent coastal zone, especially the major land uses of the area: sugar cane farming, grazing and mining; and
- c) to assist the GBRMPA in its role as lead agency for the management of the GBRWHA by developing policy outcomes of the research.

The specific research questions addressed in my research are:

- a) how has the Great Barrier Reef – especially its coral reefs, islands and marine wildlife – changed since European settlement?
- b) are those changes correlated with patterns of European settlement and land-use in the region?

²⁰ J. M. Powell, ‘Historical geography and environmental history: an Australian interface’, *Journal of Historical Geography*, Vol. 22, No. 3, 1996, pp. 253-273; S. Dovers, ‘Still settling Australia: environment, history and policy’, in S. Dovers (ed), *Environmental history and policy: still settling Australia*, Oxford University Press, South Melbourne, Victoria, 2000, pp. 2-23.

- c) what policy outcomes do any changes have for the management of the GBRWHA?
and
- d) can oral histories yield valuable information about changes in a marine environment?

The outcomes of my research are:

- a) the documentation of changes in the coral reefs, islands and marine wildlife of the Great Barrier Reef, especially since 1860, against the background of the history of the European settlement of the region and of the coastal zone;
- b) increased capacity for coral reef scientists to develop hypotheses about the nature of the impacts of anthropogenic and natural change in the GBRWHA; and
- c) increased capacity for the GBRMPA and the Queensland Environmental Protection Agency (QEPA) to fulfill their statutory obligations to protect the values of the GBRWHA in the context of anthropogenic and natural environmental change and to work with stakeholders to reduce impacts as required.

My research was designed to allow the GBRMPA to confirm or refute anecdotal reports of decline in the coral reefs, islands and marine wildlife of the Great Barrier Reef, to apply qualitative methods to the solution of an environmental problem, to write a narrative of environmental change in the Great Barrier Reef, and to create an oral history collection for deposition in the GBRMPA Library, in Townsville.

1.4 The scope of this research

In general, my research is limited to the area bounded by the GBRWHA as this is the area for which the most stringent management responsibility is borne by the GBRMPA; the boundaries of the GBRWHA also provide convenient limits to an extensive ecosystem that crosses political boundaries and that is difficult to define otherwise. However, such a definition is artificial: some environmental impacts on the Great Barrier Reef derive from outside the GBRWHA and, conversely, human activities in the GBRWHA may affect coral reefs and associated biota outside its boundaries. Therefore, my study belongs within a larger geographical context. In some cases, as in Chapter 7 where changes in marine wildlife are considered, I used some materials that related not only to the GBRWHA but that also included Torres Strait and Hervey and Moreton

Bays. The use of such data was justified because some large marine animals, including dugongs, turtles and humpback whales, range across the boundaries of the GBRWHA; hence, considering changes in these species in adjacent marine areas is directly relevant to the status of their populations in the GBRWHA. Some early European reef fisheries, including the bêche-de-mer and pearl-shell industries, also extended across the present boundary of the GBRWHA.

Temporally, the scope of my research was limited, in most cases, to the period from 1860 to 1970; during that period, the most extensive exploitation of the Great Barrier Reef took place. The former date represents the time of the earliest European settlement on the Queensland coast adjacent to the Great Barrier Reef, although earlier European exploitation of resources in the ecosystem – including bêche-de-mer – had already taken place. The latter date represents the approximate year by which more systematic investigation of the ecology of the Great Barrier Reef had begun, and for which more extensive literature exists. Therefore, my research focuses on a period of more than a century for which scant scientific data have been collected, yet in which many historical industries operated and significant transformations of the habitats of the Great Barrier Reef occurred. However, some environmental changes that occurred before 1860 – such as the construction of the Raine Island beacon, in 1844 – are included in my account as they represent significant impacts in the Great Barrier Reef; but those events are anomalies that lie outside the main period of European influence on the ecosystem: the period since 1860.

As this is a qualitative environmental history study, its scope was limited by the availability of relevant materials. Nevertheless, many available archival sources, official reports and records of several Queensland Government Departments, historical books – particularly Queensland travel and description literature – and oral histories were used extensively in order to obtain rich descriptions of environmental impacts. In addition, some of the scientific reports produced as a result of the various geological, biological and ecological expeditions to the Great Barrier Reef – including the papers of the 1928–1929 Great Barrier Reef Expedition to Low Isles – and the manuscripts of notable reef scientists such as Isobel Bennett were also analysed. Interpretation of these qualitative materials relied on the use of multiple sources wherever possible so as to allow triangulation, to cross-reference accounts, and to reveal biases. In particular, the original

oral histories that I collected were compared with documentary accounts whenever possible in an attempt to counter the subjectivity of informants. Although the period considered in my research is 1860-1970, some accounts that were written during this period were published more recently; those books have also been used in my study.

The scope of my research was also limited by some definitions that I selected. Detailed definitions of environmental history and qualitative research are provided in Sections 2.2 and 3.2 respectively and are not repeated here. Environmental changes are difficult to define, especially in a highly complex and dynamic ecosystem that is characterised by constant change at various spatial and temporal scales. In my research, I adopted a simple view of environmental changes as any alteration in the physical appearance of the coral reefs or in any of their associated phenomena; that definition was chosen as it would include the types of environmental changes likely to have been observed by oral history informants. In contrast to physical changes, many of the chemical and biological changes in the Great Barrier Reef were probably invisible to informants; nor are such changes likely to have been recorded in the documentary sources that I consulted. Therefore, my research focuses on broad-scale, observable, physical changes in the Great Barrier Reef and neglects many other changes that may have taken place. Nonetheless, little doubt exists that those human impacts that dominate the narratives presented in Chapters 5-7 constitute environmental changes; those activities represented the use of resources, and the modification of habitats, on an unprecedented scale.

1.5 Limitations of this study

In addition to the limitations imposed by the scope of my research, several other limitations also require some explanation. First, my study was constrained by difficulties in obtaining suitable oral history evidence. Oral history informants who could remember the period before the Second World War were difficult to find; those who I contacted were often unable to take part in the research because of poor health. Informants were also scarce for the period from 1945 to 1955, and the environmental history narratives for this period are comparatively sparsely supported by oral history evidence; for that period, therefore, more emphasis was placed on the use of documentary sources. In contrast, many informants were found for the period since 1970, although this period was not the focus of my research and those informants could

not provide the extended historical perspective that I sought. Informants were most easily recruited in the Cairns area, where my study was based, and the closer proximity of the Great Barrier Reef to the mainland in northern Queensland – as well as the abundance of tourist activities in the Cairns and Whitsunday areas – suggested that more informants may have encountered the Great Barrier Reef in those areas than elsewhere. A research visit was made to central and southern Queensland, and telephone interviewing was used, in order to recruit informants from other locations.

A second limitation of my research is the uneven geographical coverage of the documentary sources describing the Great Barrier Reef. In particular, the Capricorn-Bunker Group of the Great Barrier Reef is comparatively well-documented in historical books, leaflets, films and Queensland Government reports and records, reflecting the earlier popularity of the Capricorn-Bunker Group for tourism, scientific research and naturalism in comparison with the more remote Far Northern Section. The relative scarcity of documents describing the Far Northern Section hindered the triangulation of sources, as there were locations for which oral histories could not be supported by documentary sources and *vice versa*. Where my sources could not be triangulated, they were not used to derive conclusions unless a high degree of internal consistency suggested that those observations were reliable. However, the variability in geographical coverage of documentary materials underlines the fact that European access to, and uses of, the Great Barrier Reef varied along the coast of Queensland; as a result, different places within the GBRWHA have different environmental histories.

Another limitation of my study related to the use of archival materials. In two recent studies, McLoughlin has described some difficulties involved in using archival materials in New South Wales, and I encountered comparable problems for Queensland in my research.²¹ For example, the sequence of archival files of the Queensland Department of Harbours and Marine (QDHM) that relates to coral mining begins and ends abruptly; the Deputy State Archivist of the Queensland State Archives (QSA) stated that other files may have been lost when the Departmental offices in Brisbane

²¹ L. C. McLoughlin, ‘Environmental history, environmental management and the public record: will the records be there when you need them?’, *Australian Journal of Environmental Management*, Vol. 6, 1999, pp. 207-218; L. C. McLoughlin, ‘Shaping Sydney Harbour: sedimentation, dredging and reclamation 1788-1990s’, *Australian Geographer*, Vol. 31, No. 2, 2000, pp. 183-208.

were inundated during the Australia Day floods of 1974. The administration of the Great Barrier Reef involved six different Queensland and Commonwealth Government Departments, as Bowen and Bowen have acknowledged, and the archival records of those various Departments contained gaps and differed in their coverage.²² As a result of these limitations, my narratives are incomplete and the material presented in Chapter 5, for example, suggests that some environmental changes occurred for which other evidence may have been lost. To some extent, oral histories illuminated environmental changes that could not be reconstructed using surviving archival sources alone.

A further limitation of my research was the lack of an Indigenous perspective towards changes in the Great Barrier Reef. Although I contacted Aboriginal and Torres Strait Islander communities and Indigenous Land Councils, and I sought to involve Indigenous informants in my research, no such involvement took place; many communities – with the exceptions of Yarrabah, Palm Island and Umagico – did not grant permission for local residents to be interviewed. Where permission was granted, contact with informants failed to generate any recorded oral histories. Unfortunately, therefore, my environmental history study does not represent Indigenous perspectives towards the impacts of European settlers in the Great Barrier Reef. In Chapter 8, some implications of this absence of Indigenous perspectives are discussed, and that chapter suggests ways in which further research could provide an alternative environmental history narrative. Consequently, my study contains a Eurocentric bias. I have not attempted to write a postcolonial account of Indigenous resistance to European uses and perceptions of the Great Barrier Reef. Nor did I attempt to investigate the ways in which Indigenous relationships with the Great Barrier Reef were altered, and with what social, cultural, political and economic consequences; those areas of inquiry remain valuable directions for further research.

1.6 Outline of the thesis

The thesis is arranged in eight chapters, which comprise three parts. The first part (Chapters 1-4) provides the background to my research: its rationale, philosophical and methodological approaches, and historical context. In the second part (Chapters 5-7), I

²² The complexity of the administration of the Great Barrier Reef prior to the formation of the GBRMP has been described by Bowen and Bowen, *Great Barrier Reef*, p. 291.

present the three environmental history narratives of changes in the coral reefs, islands and marine wildlife of the Great Barrier Reef. The third part (Chapter 8) contains some conclusions and implications for the contemporary management of the GBRWHA.

Chapter 2 situates my research within the literature of the sub-discipline of environmental history. Many definitions of that sub-discipline exist, some of which I discuss critically. Cronon's narrative approach is contrasted with other perspectives: especially with Worster's agroecological approach.²³ Chapter 2 also contains a review of the literature about the Great Barrier Reef, including the two recent environmental histories of the Great Barrier Reef by Bowen, and by Bowen and Bowen; this review identifies a research gap for an environmental history of the Great Barrier Reef based on extensive use of archival sources and oral histories.²⁴ In Chapter 2, I also discuss some significant questions about environmental knowledge that have been raised by postmodern scholars, including the possibility that environmental historians inevitably produce the version of events that they expect to find, and I present Cronon's three criteria for ensuring that environmental history narratives do not become fictions.

Chapter 3 contains various definitions of qualitative research and outlines the methodological approach used in my study. In this discussion, I use the work of Denzin and Lincoln, who defined qualitative research as a form of interpretive practice that situates the researcher in the world, and I emphasise the similarities between their approach to qualitative research and Cronon's approach to environmental history.²⁵ Chapter 3 also contains a description of the research process and of some issues in ethical research, in which I argue that narratives of changes in the Great Barrier Reef are inseparable from ethical and moral considerations. The chapter next outlines the sources of data available, methods of data collection and analysis, and ways in which my qualitative materials were stored and protected. Chapter 3 also contains a discussion of the particular issues involved in using oral histories, including confidentiality, informed consent, and the protection of the intellectual property of informants.

²³ Cronon, 'A place for stories'; D. Worster, 'Transformations of the Earth: towards an agroecological perspective in history', *Journal of American History*, Vol. 76, No. 4, 1990, pp. 1087-1106.

²⁴ Bowen, 'Great Barrier Reef'; Bowen and Bowen, *Great Barrier Reef*.

²⁵ Denzin and Lincoln, 'Introduction'.

Chapter 4 contains a brief account of the spread of European settlement in coastal Queensland, based on secondary sources, which acts as a historical context for my research. The chapter describes the northward expansion of European activities, which was dependent upon safe navigation through Queensland coastal waters, and the closer settlement that accompanied the spread of sugar cane farming. The expansion of sugar cane farming was accompanied by substantial environmental degradation, as Griggs has acknowledged, as a result of deforestation, soil erosion and swamp drainage, which led to enhanced sediment and nutrient run-off from the GBRCA to the Great Barrier Reef.²⁶ Commercial fisheries and tourism in the Great Barrier Reef, in conjunction with rapid coastal development, also contributed increasingly to human impacts on the ecosystem. Hence, in Chapter 4, I suggest that European settlement, sugar cane farming and coastal development have been interconnected with changes in the Great Barrier Reef.

Chapter 5 forms the first of my three original narratives of environmental changes, focusing on changes in coral reefs and their associated species. In particular, the effects of early European reef fisheries, coral mining, coral collecting and shell collecting are discussed. In this chapter, evidence of sustained, extensive damage to coral reefs as a result of the removal and destruction of reef resources is presented; that evidence indicates that some coral reefs have experienced severe impacts – that have varied in their location and intensity – since European settlement. Consequently, although the Great Barrier Reef remains the most outstanding coral reef environment in the world, some of its reefs were far from pristine at the time of the formation of the GBRMP, in 1975.²⁷ As a result of human activities, some inshore reefs, such as Kings Reef (near Innisfail) and Alexandra Reef (near Port Douglas), have been degraded to the extent that recovery to their former condition is now unlikely; many other reefs have been impacted to a lesser extent.²⁸

Significant changes have taken place in many of the islands of the Great Barrier Reef: those changes are described in Chapter 6. Some islands, such as Raine and Lady Elliot

²⁶ P. Griggs, 'Environmental change in the sugar cane producing lands of Eastern Australia, 1865-1990', Conference paper presented at the International Congress of Historical Sciences, University of New South Wales, Sydney, 3-7 July 2005; P. Griggs, 'Saving the land: soil erosion, scientists and the development of conservation tillage techniques in the Australian sugar industry, 1945-1995', submitted to *Environment and History*.

²⁷ C. Wilkinson (ed), *Status of coral reefs of the world: 2000*, AIMS, Townsville, 2000.

²⁸ Appendix B lists the latitudes and longitudes of some specific reefs and islands named in this thesis.

Islands, display geomorphological evidence of disturbance as a result of the activities of guano miners. Many other islands have been modified as a result of other impacts, including military target practice, the establishment of coconut plantations, the introduction of goats, the introduction of other exotic species such as *Lantana*, the construction of airstrips and the development of tourist resorts. The evidence presented in Chapter 6 indicates that some islands of the Great Barrier Reef – particularly Raine, Green, Magnetic, Holbourne, North West, Heron, Fairfax, Lady Musgrave and Lady Elliot Islands – experienced considerable exploitation and had been significantly modified by the time of the formation of the GBRMP.

Changes in marine wildlife species in the Great Barrier Reef are considered in Chapter 7. In particular, changes in the populations of dugongs, marine turtles and humpback whales are described. Commercial fishers captured dugongs in the southern Great Barrier Reef, in Moreton and Hervey Bays, and in Torres Strait for the purpose of producing dugong oil. The intensive exploitation of green turtles for the manufacture of turtle soup occurred in the Capricorn-Bunker Group and, during the 1920s, that industry caused considerable depletion of green turtles. Hawksbill turtles were also taken, early in the period of European settlement, for the production of tortoise-shell. In addition to those commercial fisheries, Chapter 7 describes turtle farming in Torres Strait, some impacts of the Indigenous hunting of dugongs and turtles, the east Australian humpback whale fishery, and the depletion of sharks and some other fish species.

Chapter 8 presents my conclusions and also reviews the implications of the three narratives presented in Chapters 5-7 for the contemporary management of the GBRWHA. My evidence indicates that, as a result of historical activities, some coral reefs, islands and marine wildlife species in the Great Barrier Reef were far from pristine at the time of the formation of the GBRMP. Documentary and oral history evidence suggests that additional scientific research into, and monitoring of, several coral reefs, islands and marine wildlife species is necessary, and that some environments and marine wildlife species in the GBRWHA require protection from other impacts, including Indigenous hunting; however, such scientific research and monitoring must be linked with agreed performance indicators in order to ensure effective environmental management. In Chapter 8, I also evaluate the use of qualitative methods in environmental history research for a marine environment, and I argue that

documentary sources provided rich descriptions of changes in the Great Barrier Reef; in contrast, oral history sources – while yielding some distinctive evidence – were generally disappointing. Overall, the evidence presented in Chapters 5-7 suggests that the Great Barrier Reef was exploited earlier, for a longer period, in more places and more intensively than has previously been documented. That story – of the multiple changes in the Great Barrier Reef since European settlement – forms the main subject of my thesis.

2. REVIEW OF LITERATURE

Environmental history is concerned with the changing relationships between human societies and the environment. The modern sub-discipline of environmental history was defined in 1970; since that year, the sub-discipline has developed into a complex and contested academic field containing various philosophical approaches. This chapter contains some definitions of environmental history and identifies the main concerns of environmental historians. However, while the modern sub-discipline is recent, the changing relationship between humans and nature has concerned scholars for longer, and this chapter traces the evolution of environmental history thought from early, teleological conceptions to the diversity of recent approaches; in this account, I emphasise Cronon's narrative approach, which forms the basis of my research. This chapter also contains a review of the literature of the Great Barrier Reef – although few environmental histories have been written for this ecosystem – and explains the research gap for a study based on archival and oral history sources.

2. REVIEW OF LITERATURE

2.1 Introduction

My study, which investigates environmental changes in the Great Barrier Reef and their relation to changing human activities, constitutes a work of environmental history, because that sub-discipline is concerned with the changing interactions between human societies and the environment. This chapter reviews the literature of environmental history: now a diverse, contested academic field. Although the modern sub-discipline appeared comparatively recently, in 1970, anticipations of the sub-discipline are found in much earlier works and examples of environmental history thought are found in the literature of several disciplines, including geography, history, environmental science and cultural ecology. In particular, historical geographers have produced seminal works of environmental history and a significant overlap occurs between these two sub-disciplines.¹ Consequently, this chapter draws on diverse traditions, and I provide an account of the evolution of the modern sub-discipline in order to illustrate the main concerns – and the different approaches – of environmental historians.

First, in Section 2.2, I present some definitions of environmental history, most of which focus on past relationships between humans and the environment. In my study, I have used Cronon's narrative approach, which is also discussed in that section.² In Section 2.3, I review the evolution of the modern sub-discipline and I describe the diversity of that academic field. The sub-discipline contains a strong emphasis on North American environments, due partly to the preoccupation of early environmental historians with changes in those landscapes. Nonetheless, Australian studies form a distinctive subset of environmental history and a selection of those works is considered in Section 2.4. Australian studies have focused mainly on terrestrial, rural environments in the south-east of the country, and few works describe marine and coastal environments. In particular, very few environmental histories of the Great Barrier Reef have been written. Section 2.5 reviews those studies that do exist, along with other key, scientific studies of the Great Barrier Reef, and identifies the research gap for my study.

¹ J. M. Powell, 'Historical geographies of the environment', in B. J. Graham and C. Nash (eds), *Modern historical geographies*, Longman, Harlow, 2000, pp. 169-192, p. 181.

² Cronon, 'A place for stories'.

2.2 Defining environmental history

Environmental history was first defined as a subset of the North American discipline of history by Roderick Nash, who regarded the sub-discipline as the inquiry into the ‘total contact’ between humans and their habitat.³ Nash argued that the transformation of the physical landscape by human activity had been so extensive that it was no longer possible to identify areas of wilderness; as a result, he claimed, the condition of the environment is the product of human activity and inactivity: it is an artifact. Hence, in Nash’s view, the condition of the American landscape represented a historical document that revealed the activities and values of human societies. As a result, he defined environmental history as the act of ‘reading’ the landscape in order to discern the ways in which humans have perceived and altered the physical world. Although similar themes were being explored within historical geography at that time, as Powell has acknowledged, Nash’s definition is significant nonetheless: it represents the first statement that identified human-environment interactions as a distinct field of academic inquiry and that treated the landscape as a historical source in its own right.⁴

Since Nash’s definition, the literature of environmental history has expanded considerably, in part because of increasing concern about the state of the global environment. As a result, other statements have been produced; in my review, I have identified 30 definitions of environmental history, which are listed in Tables 2.1-2.3 and which are also discussed below. Their diversity reflects the evolution of a complex academic sub-discipline, and analysis of these definitions reveals significant differences between them. The definitions can be divided into three main groups: the first contains definitions of environmental history as an academic sub-discipline or multidisciplinary project (Table 2.1); the second includes many definitions that treat environmental history as the inquiry into the relationship, or reciprocal impacts, between humans and the environment (Table 2.2); and the third represents a collection of definitions that approach environmental history as a story, narrative or collection of stories about humans, nature and the unfolding ‘human dialogue with the earth’ (Table 2.3).⁵

³ R. Nash, ‘The state of environmental history’, in H. J. Bass (ed), *The state of American history*, Quadrangle Books, Chicago, 1970, pp. 249-260, p. 250.

⁴ Powell, ‘Historical geographies’, p. 179.

⁵ D. Worster, ‘History as natural history: an essay on theory and method’, *Pacific Historical Review*, Vol. 53, 1984, pp. 1-19, p. 5.

Definition 1: ‘Environmental history refers to the total contact of man [sic] with his habitat and includes everything from urban design to wilderness preservation. I regard it as a variety of intellectual history, an approach to understanding the history of thought.’

Source: Nash (1970), p. 250.

Comment: Nash regarded the North American landscape as a historical document upon which the values and activities of American societies have been inscribed. Humans have transformed the environment and left a record of their activities in the landscape; environmental history is the act of ‘reading’ the landscape to discern past human impacts. This definition was the first to treat environmental history as a distinct academic sub-discipline.

Definition 2: ‘Environmental history thus initially represented largely the political and intellectual history of the environmental movement and its predecessor, the conservation movement.’

Source: White (1985), pp. 299-300.

Comment: White reviewed the emergence of the North American sub-discipline of environmental history, first as a continuation of conservation history, and more recently as a reaction to critiques of environmental determinism. In his review, White argued that nature limits human activity and responds in unforeseen ways to human behaviour.

Definition 3: ‘At its heart, environmental history is a way of looking at the past that makes humans just one of many species striding across history’s stage.’

Source: Sanoff (1992), p. 69.

Comment: Sanoff’s definition of the field argues that environmental history provides a context for other histories, and represents an ecocentric, rather than anthropocentric, academic sub-discipline. In contrast, Cronon (1992) argued that humans are distinct from other species in their ability to construct narratives about their place in nature: narratives that reflect diverse human values, attitudes and beliefs.

Definition 4: ‘Studies which fall under the rubric ‘environmental history’ encompass a broad range – from ecology, to the impact of humans on the natural world, and to the built environment [...]. Environmental history brings together [...] the interests and skills of many disciplines, but particularly those of historians, historical geographers and ecologists. It is a multi-disciplinary study’.

Source: Garden (1993), p. 4.

Comment: Garden defined environmental history as a diverse, multidisciplinary academic field, which combines the approaches of the sciences and humanities. In this definition, however, ‘environmental history’ is treated more as a unifying term than as a distinct academic discipline.

Definition 5: The purpose of environmental history is ‘to provide a context for other kinds of human history’

Source: Simmons (1993), p. 1.

Comment: Simmons included both essentialist reconstructions of environmental change and cultural constructions of nature within the scope of environmental history. Like Sanoff (1992), Simmons regarded the sub-discipline as providing a context for other histories.

Definition 6: ‘[Environmental history’s] essential purpose is to put the nature back into historical studies, or, defined more elaborately, to explore the ways in which the biophysical world has influenced the course of human history

and the ways in which people have thought about and tried to transform their surroundings.’

Source: Worster (1993), p. 20.

Comment: This definition regards environmental history as the sub-discipline that attempts both to restore an ecological perspective to history and to investigate changing human conceptions and transformations of nature. Worster accused historians of neglecting the insights of ecology although, in contrast, Powell (1996) argued that historical geographers have often considered nature in their historical accounts.

Definition 7: ‘Environmental history exists as an independent subdivision of the discipline of history, but it remains a minor one.’

Source: Crosby (1995), p. 1188.

Comments: Crosby regarded environmental history as a sub-discipline that was tied to the environmental movement and that ignored epistemological questions about historical environmental change. Cronon (1994) disagreed, arguing that few environmental historians claim to know objective truths.

Definition 8: ‘Environmental history seems profoundly misnamed if it signals the arrival of another subdiscipline, and [...] it may be better presented and much better managed [...] as another rejuvenatory, galvanising interdisciplinary project’.

Source: Powell (1996), p. 259.

Comments: Powell acknowledged that Australian historical geographers have produced environmental histories, and argued that environmental history is an ‘interdisciplinary project’ rather than a distinct academic sub-discipline. He also identified many topics for which distinctively Australian environmental histories could be written.

Definition 9: ‘Environmental history is a young genre within the historical profession. [...] Its three main varieties are the history of landscapes (including agricultural ones); of cities and the infrastructure and pollution; and of intellectual currents concerning the natural world. But in truth countless varieties of environmental history exist.’

Source: McNeill (2001), p. xiii.

Comment: McNeill acknowledged that the distinctions between environmental history, historical geography and historical ecology are vague. Yet he also argued that the genre of environmental history is organised around one central concern: the reciprocal relationship between humans and nature. McNeill also included urban environments within the scope of the sub-discipline in his definition.

Definition 10: ‘Environmental history [...] may also be described as a research field that helps us to perceive the outlines of the past, understand the present situation, and solve the problems of the future by providing basic illuminating knowledge on environmental issues. [...] Therefore, environmental history can also be called a nature-centred or an ecocentric history of society.’

Source: Myllytaus (2001), pp. 144-145.

Comment: Myllytaus defined environmental history as a ‘research field’ with five distinctive features: a focus on the long term evolution of nature, an international perspective, an interdisciplinary approach, an orientation towards environmental problems, and a tendency to reassess conceptions of the past. This ecocentric definition, therefore, is similar to the ecological definition of the sub-discipline by Worster (1993).

Table 2.1. Some definitions of environmental history as an academic sub-discipline.

Definition 11: *Environmental history is the study of ‘the relationships between man [sic] and nature [...]. Man’s relationship to nature is not merely a unidirectional one, whereby he imposes his will upon the natural world; it is, instead, one of mutuality in which human behaviour is profoundly affected by natural forces.’*

Source: Bilsky (1980), pp. 7-8.

Comment: Bilsky argued that interactions between humans and nature are reciprocal, not simply anthropogenic.

Definition 12: *‘There is, after all, in all periods of history a broad range of human relationship to nature, involving many kinds of actions, perceptions, and unspoken assumptions [...]. Environmental history is a broader investigation of the full range of past human responses to the natural environment.’*

Source: Tate (1981), p. 8.

Comment: Tate identified four concerns of environmental history: environmental perceptions and meanings, historical uses of technology, ecological science and regulatory actions.

Definition 13: *Environmental history concerns ‘historical aspects of the relationship between human beings and the rest of nature’ and includes ‘all studies of the relationship between human societies and the natural environment through time.’*

Source: Bailes (1985), pp. 1 and 4.

Comment: Bailes identified four themes in environmental history: environmental values and attitudes, interactions between economic activity and nature, histories of the environmental and conservation movements, and the role of professionals in influencing environmental thought.

Definition 14: *‘Environmental history deals not with mankind [sic] alone – that is, not simply with social, political and economic relations and the ideas and beliefs of human beings – but with mankind in its ties with a natural setting. Or to put it a less passive way, environmental history deals with the dialectic between nature and culture, the interaction of humans with the rest of nature through time.’*

Source: Opie (1985), cited in Bailes (1985), pp. 4-5.

Comment: Opie’s definition contains three themes: an ecological object of inquiry, the legacy of environmental advocacy, and the methodologies of the humanities and arts.

Definition 15: *‘Environmental history is the study of what impact economics, politics, social structure, technologies, and value systems have had on the natural environment and the use of its natural resources. One might add that the reverse is also true: environmental history includes the study of what impact particular natural environments, and the availability or lack of particular resources, have had on human societies.’*

Source: Petulla (1985), cited in Bailes (1985), p. 6.

Comment: Petulla argued that environmental histories motivated by environmentalism can become focused solely on environmental degradation.

Definition 16: *‘It is in the midst of this compromised and complex situation – the reciprocal influences of a changing nature and a changing society – that environmental history must find its home.’*

Source: White (1985), pp. 334-335.

Comment: This definition of environmental history emphasises reciprocal influences between humans and nature.

Definition 17: *Environmental history is concerned with ‘how humans have been affected by their natural environment through time and, conversely, how they have affected that environment and with what results.’*

Source: Worster (1988), pp. 290-92.

Comment: Worster (1988, p. vii) acknowledged that environmental history ‘deals with all the interactions people have had with nature in past times’ in his definition.

Definition 18: *‘Like all complex relationships, that between humanity and the planet which it inhabits must be understood both as a system functioning now, and, from its beginning, as the product of development over time’.*

Source: Moore (1993), p. ix.

Comment: This definition of environmental history refers to the social construction of nature but also advocates the problematic task of reconstructing prehuman ecosystems.

Definition 19: *Environmental history is ‘the study of the history of human impacts on and relationships with the non-human setting. Environmental history seeks to explain the landscapes and issues of today and their evolving and dynamic nature, and from this to elucidate the problems and opportunities of tomorrow.’*

Source: Dovers (1994), p. 4.

Comment: Dovers argued that these human impacts on the environment have been generally negative and degrading.

Definition 20: *Environmental history explores ‘the reciprocal interaction between humans and their setting or, more expansively, how we have changed a given environment through time, and how it has changed us.’*

Source: Seddon (1994), p. xviii.

Comment: Seddon’s definition implies that human impacts are neither beneficial nor detrimental: the environment exists only in relation to humans – it is a human construction.

Definition 21: *The task of environmental history is the study of human relationships through time with the natural communities of which they are part, in order to explain the processes of change that affect that relationship.’*

Source: Hughes (2001), p. 4.

Comment: This definition, like those by Worster, emphasises the mutual interactions between humans and nature through time and the use of ecological ideas in history.

Definition 22: *‘Environmental history [...] takes as its province the history of reciprocal relations between society and environment, between culture and nature.’*

Source: McNeill (2001), p. xiii.

Comment: McNeill argued that reciprocal relations between humans and nature are central to the sub-discipline.

Definition 23: *‘Environmental history [...] may be described as an attempt to elucidate the interaction between humans and nature in the past.’*

Source: Myllyntaus and Saikku (2001), p. 2.

Comment: Myllyntaus’ definition is based on Worster’s agroecological approach and reflects Worster’s view of the purpose of environmental history.

Definition 24: *‘Environmental history examines interactions between nature and society in the past.’*

Source: Myllyntaus (2001), p. 144.

Comment: This definition, like the previous one, is based on Worster’s agroecological approach to environmental history.

Definition 25: *‘Environmental history [...] takes as its central theme the interaction between nature and culture [...]. It is therefore positioned between an ‘objective’ scientific history and a ‘moral history’, which is all cultural construction.’*

Source: Simmons (2001), p. 1.

Comment: This definition distinguishes between scientific and historical accounts of environmental change.

Table 2.2. Some definitions of environmental history as the study of human-nature relationships.

Definition 26: *Environmental history is concerned with 'the long-running human dialogue with the earth [...]. The natural environment is not really passive but rather is a powerful determining force throughout history. People are forever struggling with the land in an ongoing ecological dialectic [...]. The earth gets changed in the unfolding dialectic, but so do the people.'*

Source: Worster (1984), pp. 1 and 5.

Comment: Worster argued for the inclusion of materialist interpretations in environmental history. For Worster, all history is natural history, but he claimed that historians have previously ignored ecological theory in their studies.

Definition 27: *'By examining the human place on earth and understanding the many ways in which people and planet have reshaped each other, we can hope to write a new story not merely about the past but about the present and the future as well.'*

Source: Cronon (1990), p. 1131.

Comment: Cronon's definition introduced the idea that environmental history is concerned with telling stories about the human place in nature rather than with producing materialist interpretations of environmental exploitation.

Definition 28: *'The special task of environmental history is to assert that stories about the past are better, all other*

things being equal, if they increase our attention to nature and the place of people within it [...]. I would urge upon environmental historians the task of telling not just stories about nature, but stories about stories about nature.'

Source: Cronon (1992), p. 1375.

Comment: Cronon defined three sets of constraints that limit environmental histories: they cannot contravene known facts about the past, they must make ecological sense, and they are produced within community contexts.

Definition 29: *'Good environmental history and good historical geography could well be regarded as a series of place-stories.'*

Source: Williams (1994), p. 15.

Comments: In Williams' definition, environmental history overlaps with historical geography. He did not define the difference between the two fields: both produce valid stories.

Definition 30: *'Environmental history is 'the story of humanity as an often passive or distracted participant in local, regional, and world-wide ecosystems [...].'*

Source: Crosby (1995), p. 1177.

Comments: Crosby emphasised that environmental history is the story of human impacts on natural ecosystems, although he argued that environmental history has been strongly influenced by the environmental movement.

Table 2.3. Some definitions of environmental history as a dialogue or narrative.

2.2.1 Environmental history as an academic sub-discipline

In the first group of definitions, shown in Table 2.1, environmental history is regarded as a distinctive field of academic inquiry; this group includes the original definition of the sub-discipline by Nash. In many of those definitions, environmental history is considered to be a subset of the discipline of history. Crosby, for example, stated that environmental history is a minor ‘subdivision of the discipline of history’: specifically, of the discipline of North American history.⁶ Nash’s original definition treated environmental history as ‘a variety of intellectual history’ in the North American tradition; White defined the sub-discipline more specifically as the political and intellectual history of the environmental and conservation movements. Sanoff and Simmons defined environmental history as the sub-discipline that provides a context for other histories; in contrast, Worster and Myllyntaus suggested that environmental history is the sub-discipline that establishes an ecological perspective in historical studies.⁷

Two of the definitions given in Table 2.1 treat environmental history, not as a sub-discipline, but as an interdisciplinary historical project.⁸ The disciplinary status of environmental history – and especially the relationship between environmental history and historical geography – has been contested. Williams argued that significant contributions have been made by historical geographers to the field of environmental history; while he maintained that historical geography and environmental history are separate disciplines, he emphasised their shared concern with human interactions with nature.⁹ Dann and Mitman considered the disciplinary borders between environmental history and the history of ecology, arguing that both sub-disciplines face the challenge

⁶ A. W. Crosby, ‘The past and present of environmental history’, *American Historical Review*, Vol. 100, No. 4, 1995, pp. 1177-1189, p. 1188.

⁷ Nash, ‘State of environmental history’, p. 250; R. White, ‘American environmental history: the development of a new historical field’, *Pacific Historical Review*, Vol. 54, 1985, pp. 297-335, p. 299; A. P. Sanoff, ‘The greening of America’s past’, *U.S. News and World Report*, Vol. 113, No. 15, 19 October 1992, pp. 68-69; I. G. Simmons, *Environmental history: a concise introduction*, Blackwell, Oxford, 1993, p. 1; D. Worster, *The wealth of nature: environmental history and the ecological imagination*, Oxford University Press, New York, 1993, p. 20; T. Myllyntaus, ‘Environment in explaining history: restoring humans as part of nature’, in T. Myllyntaus and M. Saikku (eds), *Encountering the past in nature: essays in environmental history*, 2nd edn, Ohio University Press, Athens, Ohio, 2001, pp. 141-160, p. 144.

⁸ D. Garden, ‘Introduction’, in D. Garden (ed), *Created landscapes, historians and the environment*, comp. S. Hodges, Proceedings of the Historians and the Environment Conference, October 1992, History Institute, Victoria, Inc., Carlton, Victoria, 1992, pp. 4-6, p. 4; Powell, ‘Historical geography’, p. 259.

⁹ M. Williams, ‘The relations of environmental history and historical geography’, *Journal of Historical Geography*, Vol. 20, No. 1, 1994, pp. 3-21, p. 16.

of producing ‘histories that take into account the cultural construction of nature’ without also denying the agency of nature. The interdisciplinary nature of environmental history – and a selection of related issues and intersections – has been discussed by Pawson and Dovers.¹⁰ The definitions listed in Table 2.1, therefore, frame environmental history variously as a form of intellectual history, a sub-discipline of history, a context for other histories and an interdisciplinary project.

2.2.2 Environmental history as the study of human-nature relationships

The definitions of environmental history listed in the second group, shown in Table 2.2, share a concern with the relationship, interactions or ties between humans and nature. Those definitions suggest that, because the relationship between humans and nature has changed through time, that relationship has a particular history that is worthy of study. In contrast to Nash’s definition, in which the interactions between humans and nature were anthropogenic, Bilsky introduced the idea of reciprocal influences between humans and nature; similarly, Tate acknowledged that the relationship between humans and nature is complex, and both authors argued that this relationship should be understood as broadly as possible. Their view was shared by Bailes, who stated that environmental history includes ‘all aspects of the relationship between human societies and the natural environment through time’ and, hence, environmental history can be defined as the study of past interactions between humans and nature.¹¹ Such a view represents the most common definition of environmental history, and the relationship between humans and the environment through time is the central concern of environmental historians.

However, those definitions of environmental history face the difficulty – expressed by Tate – that all human history is to some extent environmental in nature; Terrie also

¹⁰ K. Dann and G. Mitman, ‘Exploring the borders of environmental history and the history of ecology’, *Journal of the History of Biology*, Vol. 30, 1997, pp. 291–302, p. 296; E. Pawson and S. Dovers, ‘Environmental history and the challenges of interdisciplinarity: an antipodean perspective’, *Environment and History*, Vol. 9, 2003, pp. 53–75.

¹¹ L. J. Bilsky, ‘Introduction’, in L. J. Bilsky (ed), *Historical ecology: essays on environment and social change*, Kennikat Press Corp., Port Washington, New York, 1980, pp. 7–8; T. W. Tate, ‘Problems of definition in environmental history’, *American Historical Association Newsletter*, 1981, pp. 8–10, p. 8; K. E. Bailes (ed), *Environmental history: critical issues in comparative analysis*, University Press of America, Lanham, Maryland, 1985, p. 4; D. Worster (ed), *The ends of the earth: perspectives on modern environmental history*, Cambridge University Press, Cambridge, 1988, p. vii.

considered that all histories may be environmental histories.¹² Yet several definitions given in Table 2.2 are more precise: for Tate, environmental history focuses on human actions, perceptions and assumptions; Bailes emphasised environmental values and attitudes, economic activities, histories of environmentalism and conservation, and the roles of professionals; for Opie, environmental history incorporates ecological inquiry, advocacy, and the methodologies of arts and humanities; and Myllyntaus focused on long-term natural evolution, international perspectives, interdisciplinary approaches, an emphasis on environmental problems and a revisionist approach to history.¹³ These definitions reveal significant diversity in their concerns, yet despite their differences, most emphasise the reciprocal, dialectical or mutual impacts of humans and nature.

The reciprocal impacts or influences of humans and nature form the focus of a definition by Bailes, who argued that environmental history includes both the study of economic, political, social and cultural impacts on the natural environment and the study of the impacts of particular natural environments and resources on human societies. Similarly, White stated that environmental history deals with the complexity of ‘the reciprocal influences of a changing nature and a changing society’, and Simmons suggested that the task of environmental history is to reinforce the idea of reciprocal interactions between humans and nature: interactions that have transformed the Earth’s surface.¹⁴ In these definitions, environmental history relates to the ways in which humans have altered environments through time and how those environments have in turn changed human societies. However, some authors differed in their evaluation of human impacts on the environment: Dovers regarded human impacts as being generally damaging; in contrast, Seddon argued that they have been neither necessarily beneficial nor detrimental. Other authors have emphasised natural agency: that environmental history concerns the role of nature in shaping the course of human affairs.¹⁵

¹² Tate, ‘Problems of definition’, p. 9; P. G. Terrie, ‘Recent work in environmental history’, *American Studies International*, Vol. 27, No. 2, 1989, pp. 42-65, p. 42.

¹³ Tate, ‘Problems of definition’; Bailes, *Environmental history*; J. Opie, ‘Environmental history: pitfalls and opportunities’, in K. E. Bailes (ed), *Environmental history: critical issues in comparative analysis*, University Press of America, Lanham, Maryland, 1985, pp. 22-35; Myllyntaus, ‘Environment’.

¹⁴ Bailes, *Environmental history*; White, ‘American environmental history’, p. 335; Simmons, *Environmental history*, p. 1.

¹⁵ Dovers, ‘Australian environmental history’; G. Seddon, *Searching for the Snowy: an environmental history*, St. Leonards, New South Wales, Allen and Unwin, 1994, p. xviii; D. Worster, ‘Appendix: doing environmental history’, in Worster, *Ends of the earth*, pp. 289-307; J. D. Hughes, *An environmental history of the world: humankind’s changing role in the community of life*, Routledge, London, 2001.

2.2.3 *Environmental history as a dialogue or narrative*

A third group of definitions treats environmental history as the study of the dialogue or dialectic between humans and nature, as Table 2.3 indicates. Some of those definitions are similar to those that emphasise the relationship between humans and nature. Worster, for example, defined environmental history as the study of ‘the long-running human dialogue with the earth’; to understand that dialogue, he argued, requires environmental historians to combine the insights of history and ecology, and to restore an ecological perspective in history. Worster argued that to analyse nature and culture differently is arbitrary, and that historians had ignored the insights of evolutionary biology and natural history; yet he argued that the dialectic between humans and nature also requires materialist interpretation and, consequently, he argued for a ‘new environmental history’ that investigates the roles of ideologies, social structures and organisations, and the ecological bases of cultures in shaping the environment.¹⁶

The definitions of environmental history provided by Worster exerted considerable influence within the sub-discipline. He described three levels of environmental history, which are summarised in Table 2.4. The first level is concerned with the understanding of nature itself and with the operation of past biophysical environments, including the role of human organisms within the global ecosystem. The second level of environmental history examines human institutions, systems of production, and power relations and their environmental impacts: the socio-economic dimension. The third level involves the investigation both of human perceptions of the environment and also of the myths, ethics, laws and beliefs that structure human understandings of what ‘environment’ means. For Worster, these three levels constitute a unified inquiry into the dialogue between humans and nature, forming an ‘agroecological approach’ to history. Williams has acknowledged the importance of Worster’s agroecological approach in shaping the evolution of the sub-discipline.¹⁷

However, Worster’s definition of environmental history was challenged by many authors – including Cronon, Demeritt and Williams – partly because of Worster’s use of

¹⁶ Worster, ‘History as natural history’, pp. 1-2 and 9; see also Opie, ‘Environmental history’.

¹⁷ Worster, ‘Appendix’, p. 293; Williams, ‘Relations of environmental history’.

1) UNDERSTANDING NATURE ITSELF

Environmental history is concerned with the organisation and functioning of nature in the past, including organic and inorganic elements and the human organism as it has existed within the global ecosystem.

2) THE SOCIOECONOMIC REALM

Environmental history is concerned with the interactions of human socioeconomic activity and its interactions with the physical world, including tools and labour, social relations, modes of production and the use of natural resources, human institutions and gender roles and configurations of power.

3) MENTAL/INTELLECTUAL CONSTRUCTS

Environmental history is concerned with the intangible encounters between humans and the environment, including the environmental perceptions, ethics, laws, myths and other structures of meaning that comprise human dialogues with nature and underlie human definitions and uses of the environment.

Table 2.4. The three levels of Worster's agroecological approach to environmental history.

Source: Worster, 'Appendix', p. 293.

problematic ecological concepts such as linear succession. As Williams argued, natural systems are characterised by continuous disturbance, instability and change.¹⁸ A further criticism of Worster's approach is the exclusion of the urban environment, which he regarded as a 'second nature', from his definition. Therefore, Worster's definition differs from Nash's view that almost all of the landscape is an artifact. Another author, Demeritt, also rejected the distinction between natural and human environments and argued that the entire world is now artificial. These challenges to Worster's approach, which focus on its essentialism and its use of problematic ecological concepts, are significant and they preclude the use of Worster's approach in my research. Nevertheless, Worster's agroecological approach has informed other recent works of environmental history.¹⁹

However, the third group of definitions shown in Table 2.3 includes several that develop Worster's view: the definitions by Cronon, Demeritt and Williams. Instead of adopting an ecological approach, these authors regard environmental history as the production of stories; their views are distinctive as they are based on postmodern critical theory. Cronon defined environmental history as the construction of narratives about the ways in which humans and nature have shaped each other; he argued that all histories, including environmental histories, are narratives that reflect human assumptions about nature more than they describe objective realities. Therefore, Cronon defined environmental history as the task of 'telling stories about stories about nature'. Similarly, Williams argued that environmental history is the process of telling 'a series of place-stories'. Yet both authors acknowledged that environmental histories must relate to objective realities. Environmental history, for Cronon, is the production of convincing 'nonfictions' that can help humans to look at nature in a new way.²⁰

Cronon defined three constraints, shown in Table 2.5, that limit the scope of environmental history narratives. Narratives must not contravene established facts about

¹⁸ W. Cronon, 'Modes of prophecy and production: placing nature in history', *Journal of American History*, Vol. 76, No. 4, 1990, pp. 1122-1131; Cronon, 'A place for stories'; D. Demeritt, 'Ecology, objectivity and critique in writings on nature and human societies', *Journal of Historical Geography*, Vol. 20, No. 1, 1994, pp. 22-37; Williams, 'Relations of environmental history', p. 15.

¹⁹ Worster, 'Appendix', p. 292; Demeritt, 'Ecology, objectivity and critique', p. 26; Myllyntaus, 'Environment'; T. Myllyntaus and M. Saikku (eds), *Encountering the past in nature: essays in environmental history*, 2nd edn, Ohio University Press, Athens, Ohio, 2001.

²⁰ Cronon, 'A place for stories', pp. 1373 and 1375; Williams, 'Relations of environmental history', p. 15.

1) Stories cannot contravene known facts about the past

Not all narratives represent the past equally well. Narratives are constrained by the requirement to represent key, known facts about events or their causes. Historical narratives are required to provide evidence for every assertion that they make.

2) Stories must make ecological sense

Environmental histories transform physical ecosystems into stages for human narratives within the biophysical limits of the Earth. Environmental changes are not simply historical facts: they also represent the responses of complex ecosystems.

3) Environmental historians write as members of communities

Environmental historians do not tell stories in isolation. Narratives are produced in the context of communities and are written from positions of interest and bias; they are also written for academic and public communities, and they engage in those wider discourses.

Table 2.5. Cronon's three constraints on environmental history narratives.

Source: Cronon, 'A place for stories', p. 1375.

the past, they must not contradict any known biophysical processes, and they are produced in community contexts. Within those constraints, environmental history addresses the following questions:

- What do people care most about in the world they inhabit?
- How do they use and assign meaning to that world?
- How does the earth respond to their actions and desires?
- What sort of communities do people, plants, and animals create together?
- How do people struggle with each other for control of the earth, its creatures, and its meanings?
- And on the grandest scale: what is the mutual future of humanity and the earth?²¹

These questions depart significantly from Worster's agroecological approach, focusing instead on the interpretation of meaning. Such interpretation relies on the use of storytelling since, as Cronon stated, 'narrative is among our most powerful ways of encountering the world, judging our actions within it, and learning to care about its many meanings.'²²

Cronon identified the position of the narrator as a critical element in environmental history. He argued that the plot of a narrative depends on the perspective of the narrator – all environmental histories are subjective, for they are so linked with the human desire to find meaning that historians cannot avoid shaping their narratives according to preconceived plots. Cronon compared two accounts of the North American Dust Bowl of the 1930s, by Bonnifield and Worster. Despite having access to the same sources, Cronon found that those scholars told entirely different stories: Bonnifield's optimistic account portrayed resilient settlers surviving natural hardships; in contrast, Worster's account was shaped by a tragic plot and emphasised environmental degradation.²³ Cronon concluded that environmental history uses narratives, which are essential to human understandings of history and of the place of humans in nature. Since narrative is a distinctively human way of interpreting reality, its role in the production of environmental histories should be acknowledged; furthermore, environmental historians cannot avoid the responsibility of making value judgments about the past.²⁴

²¹ Cronon, 'A place for stories', p. 1376.

²² Cronon, 'A place for stories', p. 1375.

²³ P. J. Bonnifield, *The Dust Bowl: men, dirt, and depression*, University of New Mexico Press, Albuquerque, 1979; D. Worster, *Dust Bowl: the Southern Plains in the 1930s*, Oxford University Press, New York, 1979; Cronon, 'A place for stories'.

²⁴ Cronon, 'A place for stories', p. 1350.

The diversity of the definitions presented above reflects the complexity of the sub-discipline; some of the tensions within the sub-discipline are evident in those definitions. One significant tension concerns the extent to which the terms ‘human’ and ‘nature’ are regarded as essential or as socially constructed categories. Worster adopted an essentialist position, arguing that industrial capitalist societies have transformed the earth in qualitatively different ways to other human societies, using increasingly exploitative modes of production, and bringing about ecological crises. Similarly, Dovers’ definition is essentialist: environmental history is the investigation and description of past biophysical conditions and the inquiry into the history of human interactions with nature. In contrast, Cronon stressed the socially constructed nature of environmental histories; he anticipated the view of Demeritt, who claimed that pre-human environmental conditions cannot be reconstructed.²⁵

Another contemporary issue in the definition of the sub-discipline is the extent to which environmental history should be concerned with solving environmental problems. Dovers proposed a utilitarian view; he defined environmental history as the attempt to explain the state of the present environment: in particular, the investigation of the changing nature of landscapes and the occurrence of environmental problems over time.²⁶ Dovers argued that environmental degradation – and its reversal – is an especially important theme within the sub-discipline and he argued that environmental history is relevant in informing environmental restoration, management and policy. Similarly, Clapp regarded environmental problem-solving as a crucial part of environmental history. Yet Dovers conceded that narratives also have intrinsic value: there are ‘good stories’ to tell about changes in the environment. Authors such as Cronon and Demeritt have focused less on the solution of ecological problems; for example, Demeritt argued that, since all landscapes are human, environmental history should instead describe the process of shaping the world to suit human preferences.²⁷

²⁵ Worster, ‘Transformations of the earth’, pp. 1087-1106; Dovers, ‘Australian environmental history’, p. 4; Cronon, ‘Modes of prophecy’; Cronon, ‘A place for stories’; Demeritt, ‘Ecology, objectivity and critique’.

²⁶ Dovers, ‘Australian environmental history’, p. 4.

²⁷ B. W. Clapp, *An environmental history of Britain since the Industrial Revolution*, London, Longman, 1994; W. Cronon, ‘Cutting loose or running aground?’, *Journal of Historical Geography*, Vol. 20, No. 1, 1994, pp. 38-43; Demeritt, ‘Ecology, objectivity and critique’.

Environmental history, then, faces significant challenges from postmodern critical theory: about the validity of the categories, ‘human’ and ‘nature’, and about the validity of reconstructing the past. As a result, definitions of environmental history have diversified since Nash’s view of the landscape as a historical document that reveals past human activities. The sub-discipline now contains many positions; but the central concern of most environmental historians is the past relationships, reciprocal interactions or dialogue between humans and the environment. For Worster, environmental history is the materialist interpretation of human impacts on nature; for Cronon, environmental history is the production of narratives about human and environmental changes that reflect the position of the narrator.²⁸ The sub-discipline is also defined as a form of academic history – as a context for other histories, a subset of history or an interdisciplinary historical project – and now contains both essentialist and social constructivist views.

As a result of the problems that characterise essentialist definitions of environmental history that have been described above – including the use of problematic ecological concepts and the impossibility of reconstructing objective environmental changes – my research adopts Cronon’s position. However, even environmental historians who have used postmodern approaches – telling interconnected stories of human and environmental change – have not avoided the use of the problematic, essentialist categories, ‘human’ and ‘nature’. Cronon argued that the difficulty of defining both of these terms, and the impossibility of genuinely knowing either, present a paradox with which environmental historians must work: to write anything meaningful about the past, scholars must use essentialist categories, but environmental historians cannot avoid telling stories about past environmental changes in subjective ways. Cronon’s work implies that any environmental history of the Great Barrier Reef is itself a representation and should be interpreted critically.²⁹

In my research, I define environmental history as the story of the changing relationship between humans and the environment through time. I also accept Cronon’s view that environmental history is the production of a narrative that is bounded by three constraints: known facts, ecological sense and community context. However, my

²⁸ Worster, ‘Appendix’; Cronon, ‘A place for stories’.

²⁹ Cronon, ‘Cutting loose or running aground?’, *passim*.

account is also the story of particular humans (European settlers) interacting with a particular environment (the Great Barrier Reef) during a particular time (1860-1970); hence, inevitably, I have used some aspects of Worster's approach and assumed that the Great Barrier Reef is to some extent an independent, knowable reality. The social construction of nature is well established in the literature of environmental history, yet it is valuable to regard the environment as an entity that is still capable of responding to human behaviour in unpredictable ways. Such a view, Cronon argued, does not overlook the agency of nature in environmental history.³⁰

2.3 The evolution of the sub-discipline of environmental history

The sub-discipline of environmental history has a complex history; the overview of the evolution of the sub-discipline presented in this section places the diverse positions of modern scholars in context. Some of the main influences on the evolution of the sub-discipline are described below; those themes are also shown in Figure 2.1. In the account that follows, I review some seminal works of environmental history, many of which were published before the creation of the sub-discipline in 1970. Ideas about environmental history developed contemporaneously in different places, however, and Figure 2.1 represents a simplification of the literature. Furthermore, in this section, non-Anglophone traditions – such as the *Annales* School of French history – are neglected; instead, my review focuses on the development of environmental history in North America, since that tradition exerted the strongest influence on Australian works. Many other overviews of the evolution of the sub-discipline have been written, of which White's review of North American environmental history forms a seminal account.³¹ In 2001, a further review of the sub-discipline was published, in *Pacific Historical Review*,

³⁰ Cronon, 'Cutting loose or running aground?', p. 43.

³¹ Overviews of the evolution of environmental history include Nash, 'State of environmental history'; L. Rakestraw, 'Conservation historiography: an assessment', *Pacific Historical Review*, Vol. 41, 1972, pp. 271-288; D. N. Jeans, 'Wilderness, nature and society: contributions to the history of an environmental attitude', *Australian Geographical Studies*, Vol. 21, 1983, pp. 170-182; White, 'American environmental history'; P. G. Terrie, 'Recent work in environmental history', *American Studies International*, Vol. 27, No. 2, 1989, pp. 42-65; M. Williams, '"The end of modern history"??', *The Geographical Review*, Vol. 88, No. 2, 1998, pp. 275-300; P. Coates, 'Clio's new greenhouse', *History Today*, Vol. 46, No. 8, 1996, pp. 15-22; Crosby, 'Past and present'; J. MacKenzie, 'Empire and the ecological apocalypse: the historiography of the imperial environment', in T. Griffiths and L. Robin (eds), *Ecology and empire: environmental history of settler societies*, University of Washington Press, Seattle, 1997, pp. 215-228; D. Lowenthal, 'Environmental history', *History Today*, Vol. 51, No. 4, 2001, pp. 36-42.

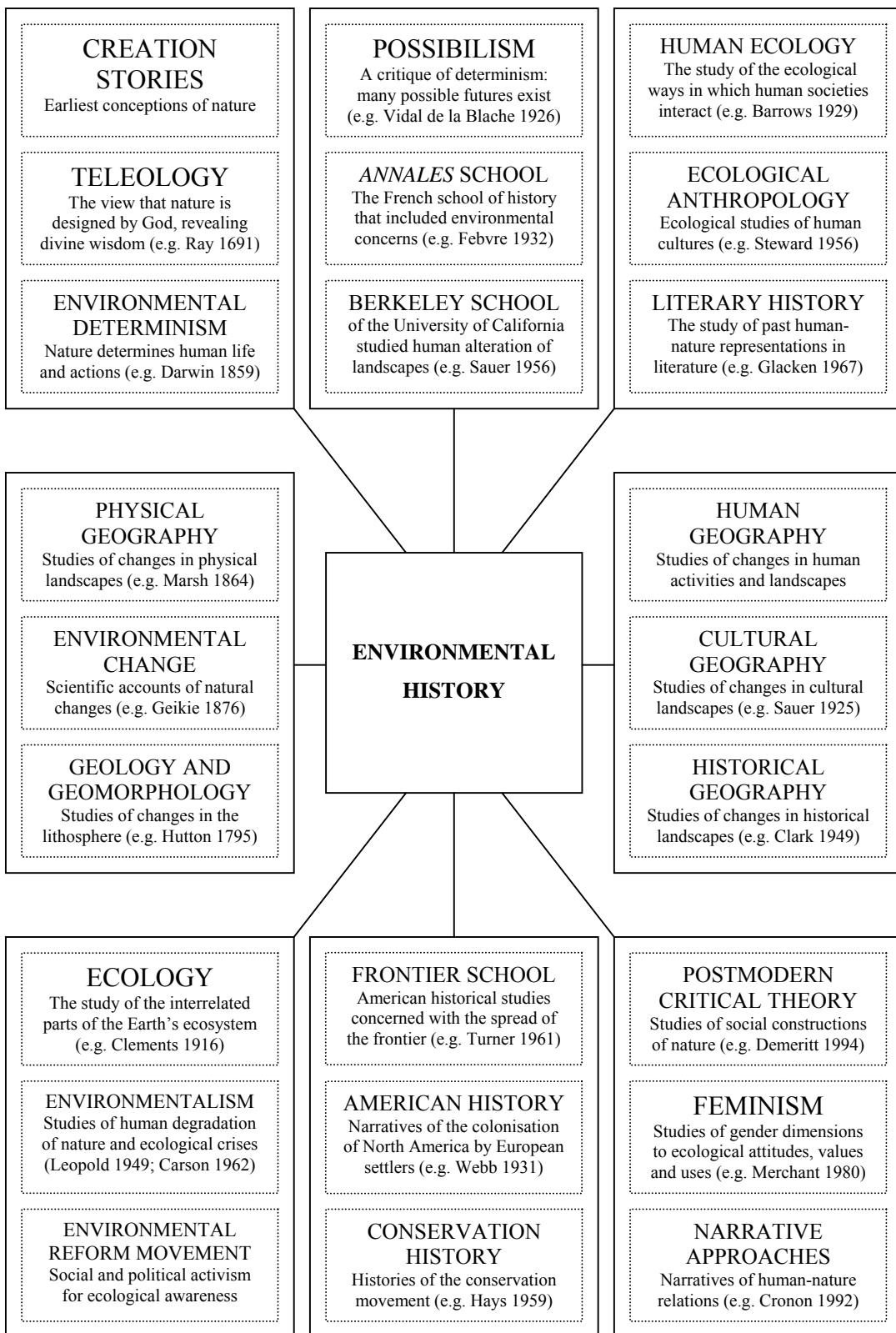


Figure 2.1. Some significant influences in the evolution of environmental history.

in which six authors discussed the scope and evolution of the sub-discipline, and to which White contributed a second historiography that extended his earlier review.³²

My review of the literature of environmental history is based on the scheme outlined in Figure 2.1 in which diverse elements in the evolution of the sub-discipline are grouped together for convenience. Those elements represent a selection of the important influences in the development of environmental history thought, although not all are considered in detail below. The evolution of the sub-discipline can be subdivided into four main phases: a pioneering phase, the development of environmental history in the different schools of British historical geography and French and North American history, the definition of the sub-discipline within the discipline of North American history, and the emergence of new directions in recent environmental history scholarship. These four phases are discussed in turn below. The elements shown in Figure 2.1 run through this narrative and contribute to the complexity of the modern sub-discipline; the pioneering phase of environmental history, for example, was strongly influenced by teleology and environmental determinism, while the discipline of ecology has informed more recent works of environmental history.

2.3.1 *The pioneering phase in environmental history*

Glacken has argued that the tradition of rational, written environmental history first developed within Western societies. He stated:

The idea that there is a continuous interaction between man [sic] and his environment – man changing it and being influenced by it – also has its mythological antecedents, but its full development belongs basically, I think, to rational thought, because such a conception requires a sense of history.³³

³² S. P. Hays, ‘Toward integration in environmental history’, *Pacific Historical Review*, Vol. 70, No. 1, 2001, pp. 59-68; J. D. Hughes, ‘Global dimensions of environmental history’, *Pacific Historical Review*, Vol. 70, No. 1, 2001, pp. 91-102; D. A. Johnson, ‘Environmental history, retrospect and prospect’, *Pacific Historical Review*, Vol. 70, No. 1, 2001, pp. 55-58; C. Miller, ‘An open field’, *Pacific Historical Review*, Vol. 70, No. 1, 2001, pp. 69-76; V. Norwood, ‘Disturbed landscape/disturbing processes: environmental history for the twenty-first century’, *Pacific Historical Review*, Vol. 70, No. 1, 2001, pp. 77-90; R. White, ‘Afterword environmental history: watching a historical field mature’, *Pacific Historical Review*, Vol. 70, No. 1, 2001, pp. 103-112.

³³ C. J. Glacken, *Traces on the Rhodian shore: nature and culture in Western thought from ancient times to the end of the eighteenth century*, Berkeley, University of California Press, 1967, p. 4.

Therefore, my review of the evolution of environmental history does not include ancient sources, but focuses on more recent conceptions. Anticipations of the modern sub-discipline exist in Western literature since the eighteenth century in seminal works, by authors such as Buffon and Marsh, which predated the emergence of the sub-discipline.³⁴ Yet despite the variety of disciplines that contributed to environmental history (Figure 2.1), those diverse, early works share a concern with the changing historical relationships between humans and the environment.

The earliest works of environmental history emerged as critiques of teleology: the belief that the earth is a divine creation and that humans form the apex of a natural order (Figure 2.1). Such a view informed the work of Ray, who believed that the apparent complexity and order of nature implied the existence of a designer, and that nature is as a stable order that gradually achieves perfection in all its details. Similarly, Bruckner argued that an organic force, or life principle, had been unleashed over the earth's surface so as to ensure the greatest possible variety of living creatures. The teleological view, although influential in Western societies, was challenged by evidence that humans had in fact drastically reduced the abundance of terrestrial life; furthermore, different environments and cultures existed in different places, raising doubts about a single, consistent design in nature.³⁵ Consequently, the earliest written works of environmental history presented an alternative point of view, arguing that change, not stasis, characterised environmental history. This view was expressed by Buffon, who questioned the perceived stability of nature and wrote a new account of the relationship between humans and nature in which different environments had particular histories.³⁶ His work was the first to be concerned specifically with the impact of humans on nature, and this text represents the earliest written work of environmental history.

Buffon, then, represents the first of the pioneers of environmental history, some of whose names are provided in Figure 2.2. He argued that, rather than completing a stable

³⁴ G. L. Compte de Buffon, *Des époques de la nature*, ed. J. Roger, Éditions du Muséum, Paris, 1962 (1779); G. P. Marsh, *Man and nature; or, physical geography as modified by human action*, ed. D. Lowenthal, Harvard University Press, Cambridge, Massachusetts, 1965 (1864).

³⁵ J. Ray, *The wisdom of God manifested in the works of the creation*, London, 1691; J. Bruckner, *A philosophical survey of the animal creation*, London, 1768; Glacken, *Traces on the Rhodian shore*, *passim*.

³⁶ Buffon, *Des époques de la nature*, *passim*.

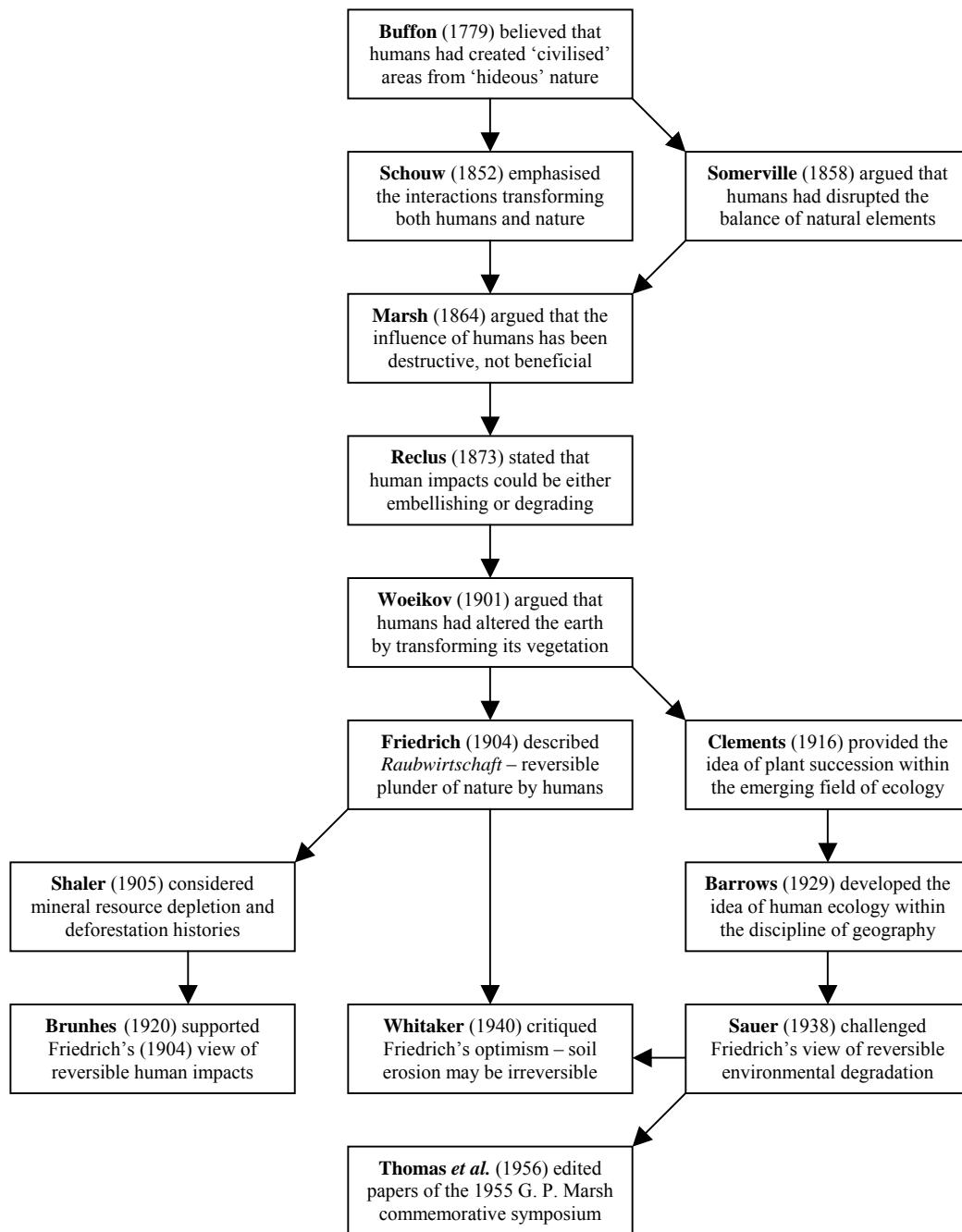


Figure 2.2. Some pioneers of environmental history and their key works.

creation, humans had profoundly altered the environment over time. He reconstructed an environmental history, shown in Table 2.6, in which humans dominated the last of seven epochs of nature. Buffon stated that nature was not a passive stage for history, but had been transformed by human societies, and that:

the state in which we see nature today is as much our doing as hers [*sic*]; we have learned to temper her, to modify her, to bend her to our needs, to our desires; we have worked, cultivated, fertilised the earth: the way in which she presents herself now is hence very different than it was in the time before the invention of the arts.³⁷

For Buffon, nature did not reflect divine glory, but was a hideous entity to be civilised; yet he acknowledged that those places which had been settled since antiquity had experienced the most severe human impacts: forest clearance, the draining of marshes, the diversion of rivers and the removal of pests and weeds. As a result of imperialism, those impacts had affected increasing areas of the earth's surface. Rather than a stable environment, Buffon perceived a pattern of continuous change and, hence, the possibility of reconstructing diverse former environments. In an anticipation of Nash's view, Buffon stated that 'the entire face of the earth today bears the imprint of the power of man [*sic*]': it is an artifact.³⁸

After Buffon, a Danish geographer, Schouw, considered the relationship between society and nature; but in contrast to prevailing ideas of environmental determinism (Figure 2.1), Schouw considered human impacts on nature, stating:

Man [*sic*] is a part of nature; she [*sic*] acts upon him, and he is subject to her laws; yet man stands, as it were, outside nature, and hence is capable of reacting upon her in a totally different way from all other creatures – of transforming her, and even to a certain extent to conquering and prescribing laws to her. Civilisation [...] is the means by which man has gradually freed himself from the rule of nature, and passed, as it were, from the position of a servant to that of a master.³⁹

Schouw, like Buffon, argued that human impacts had exceeded natural forces. He claimed that 'culture, or civilisation, had destroyed the original beauty of nature', although he argued that the benefits of civilisation compensated for the loss of natural

³⁷ Buffon, *Des époques de la nature*, p. 4, my translation.

³⁸ Buffon, *Des époques de la nature*, pp. 205 and 211, my translation.

³⁹ J. F. Schouw, *The earth, plants and man: popular pictures of nature*, trans. and ed. A. Henfrey, Henry G. Bohn, London, 1852, p. 228.

Epoch 1: During the first epoch, the Earth and the other planets were formed (Buffon 1779, p. 25).

Buffon argued that the planets developed differently as a result of varying rotation rates. The planets and their satellites cooled from liquefied states and solidified. Buffon described the production of volatile materials around the Earth and the formation of solids, air, and water on the Earth's surface.

Epoch 2: During the second epoch, the material that was consolidated formed rock in the interior of the Earth and the large rock masses at the surface (Buffon 1779, p. 45). Buffon described the first forms appearing at the surface, or in the interior, of the Earth: mountains, valleys, caverns, and faults. Chains of mountains were created at the surface. Surface water collected, and veins of metals formed.

Epoch 3: During the third epoch, water covered the continents (Buffon 1779, p. 69). Volatile material came out of suspension and covered the plains of the Earth. The atmosphere separated from the waters; this allowed vegetation and animals to populate the Earth. Calcareous rocks and sands formed. Buffon also described the formation of schists, carboniferous rocks, coals, and bitumens.

Epoch 4: During the fourth epoch, the waters retreated and volcanoes became active (Buffon 1779, p. 117). Buffon described the rise of the waters, from Polar regions, until they had covered the entire surface of the Earth, apart from some ancient mountains. The level of the land was raised and deposition of sediments occurred. Volcanic eruptions poured solid material onto the Earth's surface.

Epoch 5: During the fifth epoch, elephants and other animals of the tropics inhabited the northern lands (Buffon 1779, p. 139). The tropical parts of the globe were uninhabitable until later in the Earth's history, as they were still too hot. Buffon argued that the animals of tropical countries had previously inhabited the lands of the North. The first human populations appeared on Earth.

Epoch 6: During the sixth epoch, the separation of the continents took place (Buffon 1779, p. 163). The vast seas of the southern hemisphere were formed. Buffon described the formation of a terrestrial, boreal hemisphere in the north and a maritime hemisphere in the south. Buffon (1779, p. 188) described the formation of Korea, China, Japan, the Philippines, New Guinea, and New Holland.

Epoch 7: During the seventh epoch, the power of man [*sic*] seconded that of nature (Buffon 1779, p. 205). Buffon acknowledged the impacts of many civilizations, referring to the impacts of the Chaldeans, Persians, Egyptians, Greeks, Romans and other European civilisations. Buffon argued that humans had observed and cultivated nature, and had made improvements and scientific advances.

Table 2.6. Buffon's seven epochs of nature.

Source: Buffon, *Des époques de la nature, passim.*

beauty. In contrast, the American geographer, Somerville, criticised human actions more strongly and argued that human actions had severely degraded the environment (Figure 2.2).⁴⁰

In 1864, another American geographer, Marsh, published a seminal work of environmental history, entitled *Man and nature*, in which he argued that human agency had transformed nature; in this work, he blamed human ignorance for disturbing the ‘harmonies’ of nature. Marsh described land degradation in new colonies, destruction of animals, introduction of foreign species, clearance of forests and changes in hydrological regimes. He also identified secondary effects of these changes, including soil erosion, siltation and nutrient run-off. In contrast to Buffon’s view of civilising human impacts, Marsh acknowledged ‘the extent of the changes produced by human action in the physical conditions of the globe’ and argued that humans were not perfecting the environment, but destroying it. *Man and nature* represents a detailed empirical attempt to describe the extent of the human transformation of nature.⁴¹

Like Buffon’s work, Marsh’s environmental history is comparative: the Old World experienced a long period of decay while the New World deteriorated rapidly; such a perspective represents a Eurocentric view of environmental degradation in the New World, although Tyrrell has acknowledged the broader scope of some areas of Marsh’s thought.⁴² Marsh acknowledged the difficulties involved in distinguishing natural from anthropogenic environmental changes, and that attempts to reconstruct pre-human environments were problematic; yet he argued that pre-colonial environments in North America could be reconstructed and that environmental decline – including deforestation – had occurred only since British settlement. Furthermore, he suggested that the New World, including Australia, provided valuable evidence of environmental decay in progress.⁴³ As a result of his extensive analysis of human destruction of the environment, Marsh represents one of the most significant pioneers of environmental history (Figure 2.2).

⁴⁰ Schouw, *Earth, plants and man*, p. 232; M. Somerville, *Physical geography*, Murray, London, 1848.

⁴¹ Marsh, *Man and nature*, p. 3; see also p. 35; the significance of Marsh’s work has been acknowledged by J. D. Hughes, ‘Preface: beginning with Rome’, *Environment and History*, Vol. 10, 2004, pp. 123-125; and by I. Tyrrell, ‘Acclimatisation and environmental renovation: Australian perspectives on George Perkins Marsh’, *Environment and History*, Vol. 10, 2004, pp. 153-167.

⁴² Tyrrell, ‘Acclimatisation and environmental renovation’, p. 154.

⁴³ Marsh, *Man and nature*, p. 49.

Marsh influenced the French geographer, Reclus, who also considered human degradation of nature. Reclus stated: ‘Innumerable changes [...] have been effected by man [*sic*] in all parts of the world, and they have revolutionised the correlations existing between man and the land he lives in.’⁴⁴ He described human degradation of nature but, unlike Marsh, he emphasised the capacity of societies to conserve and restore nature. In Australia, Reclus argued, European settlers had used technology to become independent of their surroundings and to exploit scarce resources; in doing so, settlers had altered the Australian environment.⁴⁵ Reclus displayed a Cornucopian perspective towards the human transformation of Australia, for he argued that the degradation caused by settlers would eventually be rectified by technology. His work influenced that of the Russian geographer, Woeikov; in turn, Woeikov influenced a German geographer, Friedrich, who developed the concept of *Raubwirtschaft*: the plunder of nature by human societies.⁴⁶ Friedrich stated:

I can conceive the *Raubwirtschaft* of our times as a depletion of land, wild plants, and animals, which will disappear quickly as the culture of northwest Europe is substituted for that of colonial and primitive peoples. Such a substitution will bring an intensive use of earth resources which aims at a firmer and firmer establishment of man [*sic*] on the earth.⁴⁷

For Friedrich, however, the plunder of nature was a temporary, reversible consequence of European cultural development; he argued that the destruction of the environment in order to extract resources would eventually lead to wiser use of nature. The theme of resource exploitation – particularly mineral extraction and deforestation – was developed by the American geographer, Shaler (Figure 2.2).

Friedrich and Shaler shared the view that the environment was being degraded by human activity, but that it was also capable of recovering. Yet the idea of the plunder of nature by humans also influenced the French geographer, Brunhes, who acknowledged the interrelatedness of all parts of the physical environment. Hence, Brunhes argued,

⁴⁴ E. Reclus, *The earth and its inhabitants: Europe*, Vol. 1, ed. E. G. Ravenstein, D. Appleton, New York, 1882, p. 5.

⁴⁵ E. Reclus, *Australasia*, ed. A. H. Keane, Virtue and Co., London, c.1882, p. 353.

⁴⁶ A. Woeikov, ‘De l’Influence de l’homme sur la terre’, *Annales de Géographie*, Vol. 10, 1901, pp. 97-114 and 193-215.

⁴⁷ E. Friedrich, ‘Wesen und geographische Verbreitung der “Raubwirtschaft”’, *Petermanns Mitteilungen*, Vol. 50, 1904, pp. 68-79 and 92-95, p. 95; cited in J. R. Whitaker, ‘World view of destruction and conservation of natural resources’, *Annals of the Association of American Geographers*, Vol. 30, No. 3, 1940, pp. 143-162, p. 157.

environmental devastation had resulted in ‘not a catastrophe, but a series of catastrophes’.⁴⁸ Brunhes wrote in the context of emerging ecological ideas, which played a significant role in the evolution of environmental history, since ecology could offer new ways of interpreting history. In 1923, the American geographer, Barrows, proposed an ecological view of history and defined the field of human ecology; subsequently, as a critique of environmental determinism, the possibilist view – that alternative possible futures were faced by human societies – was developed by several geographers of the ‘Berkeley School’ of the University of California: in particular, by Sauer (Figure 2.2).⁴⁹

Sauer distinguished between natural and cultural landscapes, arguing that cultural landscapes were formed from natural landscapes by human agency. He argued that, in creating cultural landscapes, humans transformed the environment; consequently, humans formed a ‘distinct agent of modification’ of nature. Unlike Friedrich, who believed that human actions led to temporary environmental changes, Sauer argued that some human actions caused permanent degradation. Such a view was significant: previously, even Marsh suggested the possibility of restoring the disturbed ‘harmonies’ of nature.⁵⁰ Sauer acknowledged that the relationship between humans and the environment could be reinterpreted every time that culture groups changed. His work demonstrates that historical interactions between humans and nature received attention from geographers; his work also indicates that, by 1925, environmental history thought had become complex and their theoretical basis was being explored. Therefore, Sauer’s work marks the close of the pioneering phase of environmental history (Figure 2.2).

2.3.2 *The development of environmental history in different traditions*

The development of environmental history continued in several different traditions, three of which are illustrated in Figure 2.3. One tradition developed in Anglo-American

⁴⁸ J. B. Brunhes, *Human geography*, Rand McNally, New York, 1920, p. 322.

⁴⁹ H. H. Barrows, *Geography: southern lands*, Silver, Burdett and Co., New York, 1929; C. O. Sauer, ‘The morphology of landscape’, *University of California Publications in Geography*, Vol. 2, 1925, pp. 19-54; C. O. Sauer, ‘Foreward to historical geography’, *Annals of the Association of American Geographers*, Vol. 31, 1941, pp. 1-24; C. O. Sauer, *Northern mists*, University of California Press, Berkeley, 1968.

⁵⁰ C. O. Sauer, *Land and life: a selection from the writings of Carl Ortwin Sauer*, ed. J. Leighly, University of California Press, Berkeley, 1963, p. 333; C. O. Sauer, ‘Theme of plant and animal destruction in economic history’, *Journal of Plant Economics*, Vol. 20, 1938, pp. 765-775; Sauer, ‘Foreward’; Marsh, *Man and nature*, p. 35.

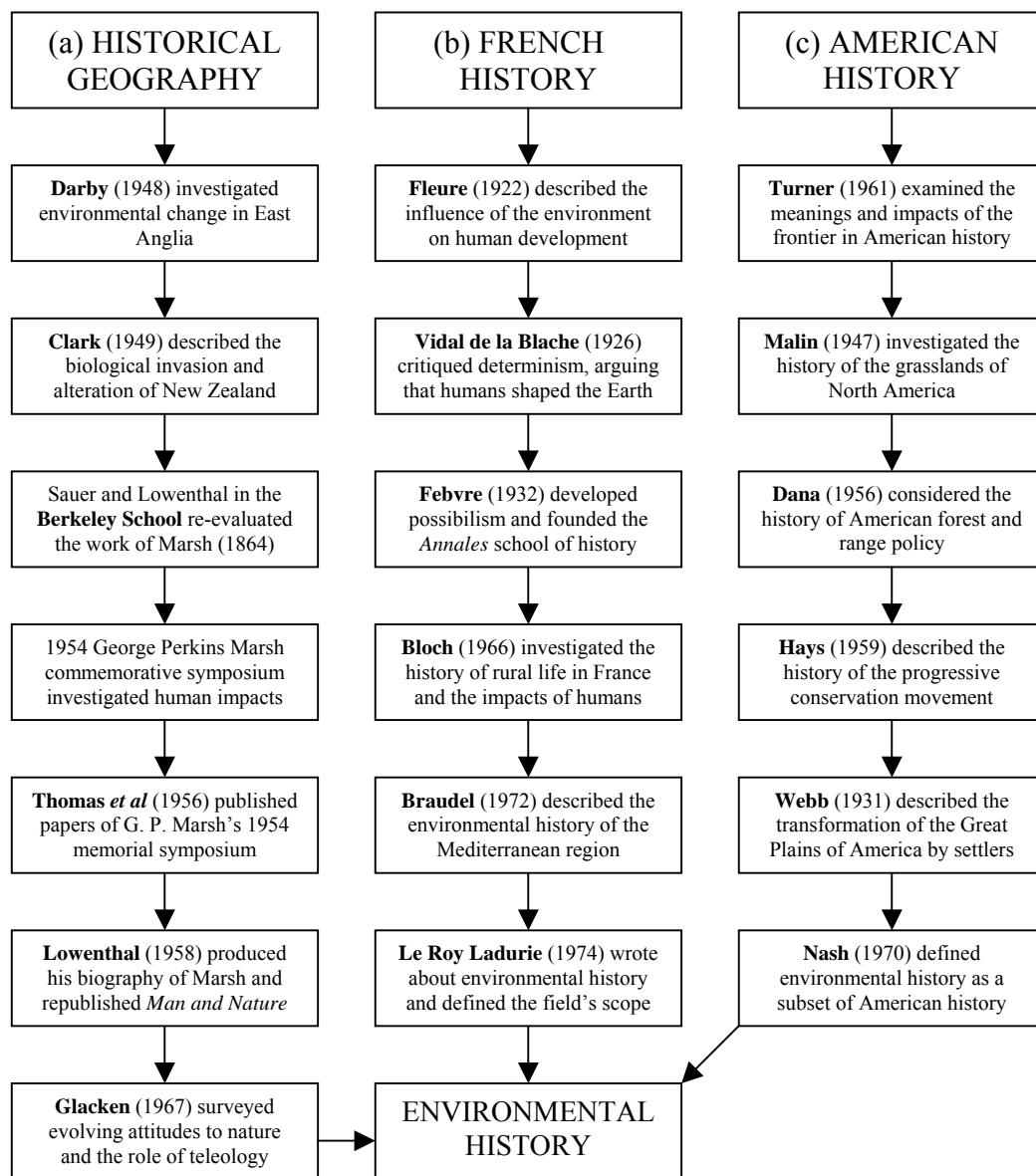


Figure 2.3. Three traditions of environmental history: (a) Anglo-American historical geography; (b) French historical studies; and (c) American historical studies.

historical geography, which focused on changes in European and North American environments. That tradition included the work of the British geographer, Darby, who investigated the transformation of the English landscape, from 1000 to 1250, using records found in the Domesday Book; he also studied the deterioration of the English fens, in modern East Anglia, following their drainage and cultivation. Such works established environmental history as a major theme in British historical geography and influenced later scholars, including Simmons and Clapp.⁵¹ Human transformations of the environment were also investigated by the American historical geographer, Clark, who reconstructed changes in New Zealand vegetation since European settlement.⁵²

The tradition of environmental history that developed within historical geography continued in the work of the Berkeley scholars (Figure 2.3). The value of Marsh's work was acknowledged with the re-editing of *Man and nature* by Lowenthal; at that time, Sauer, Lowenthal and other scholars reassessed the human-environment relationship.⁵³ For Sauer, 'environment' was a cultural term that acquired meaning through a historical process; understanding human adaptations to the environment thus involved reconstructing the histories of culture groups. This innovative view of culture as the agent of environmental change provoked a 1955 symposium, entitled *Man's role in changing the face of the earth*. Sauer stated that the symposium was concerned with 'the capacity of man [sic] to alter his natural environment, the manner of his doing, and the virtue of his actions', including the cumulative effects of human activities, the physical and biological processes that humans had influenced, and cultural differences in environmental impacts.⁵⁴ The proceedings of that symposium synthesised many contemporary ideas about environmental history within the discipline of geography, and that collection represents a summary of environmental thought since the work of Marsh.

⁵¹ H. C. Darby, 'The economic geography of England, A.D. 1000-1250', in H. C. Darby (ed), *An historical geography of England before 1800: fourteen studies*, Cambridge University Press, Cambridge, 1948, pp. 165-229; H. C. Darby, 'The draining of the fens, A.D. 1600-1800', in H. C. Darby (ed), *An historical geography of England before 1800: fourteen studies*, Cambridge University Press, Cambridge, 1948, pp. 444-464; Simmons, *Environmental history*; Clapp, *Environmental history*.

⁵² A. H. Clark, *The invasion of New Zealand by people, plants and animals: the South Island*, Rutgers University Press, New Brunswick, 1949; a similar type of reconstruction was made, a global scale, by M. Williams, 'Dark ages and dark areas: global deforestation in the deep past', *Journal of Historical Geography*, Vol. 26, No. 1, 2000, pp. 28-46.

⁵³ D. Lowenthal, 'Nature and morality from George Perkins Marsh to the millennium', *Journal of Historical Geography*, Vol. 26, No. 1, 2000, pp. 3-27.

⁵⁴ Sauer, *Land and life*, p. 359; W. L. Thomas *et al.*, *Man's role in changing the face of the earth*, University of Chicago Press, Chicago, 1956; C. O. Sauer, 'The agency of man on the earth', in Thomas *et al.*, *Man's role*, pp. 49-69, p. 49.

One seminal work by a historical geographer – *Traces on the Rhodian shore* – investigated the history of Western attitudes towards nature from antiquity to the eighteenth century. Using literary sources, Glacken argued that three principal ideas had characterised human attitudes towards nature; he stated:

In the history of Western thought, men [sic] have persistently asked three questions concerning the habitable earth and their relationships to it. Is the earth, which is obviously a fit environment for man and other organic life, a purposefully made creation? Have its climates, its relief, the configuration of its continents influenced the moral and social nature of individuals, and have they had an influence in molding the character and nature of human culture? In his long tenure of the earth, in what manner has man changed it from its hypothetical pristine condition?⁵⁵

Therefore, Glacken suggested that teleology, determinism/possibilism and human agency form the three main paradigms that have articulated human attitudes to nature and that explain changing relationships between humans and the environment. He argued that a geography of environmental attitudes existed, since environmental changes have been made by particular people at particular times, and in different places. Glacken's extensive analysis was limited to the period before the end of the eighteenth century, although he provided a brief overview for the nineteenth century; nonetheless, *Traces on the Rhodian shore* represents a key text of environmental history and immediately anticipated the modern sub-discipline (Figure 2.3).⁵⁶

While studies of environmental history were being produced within the British and American schools of historical geography, a parallel tradition developed in the *Annales* School of French history (Figure 2.3). The *Annalistes* incorporated geographical themes in their historical analyses; this type of synthesis had already taken place in the work of Fleure, who acknowledged that a geography of environmental influence on cultural development existed.⁵⁷ However, the *Annalistes* also advocated a form of possibilism in the tradition of the geographer, Vidal de la Blache, who argued that both historical and environmental analyses were interdependent. Describing the view of Vidal de la Blache, Fleure stated that ‘living beings, man [sic] most of all, and their environments are ever acting, as well as reacting, on one another, to produce change.’ For Vidal de la Blache,

⁵⁵ Glacken, *Traces on the Rhodian shore*, p. vii; see also p. 7.

⁵⁶ C. J. Glacken, ‘Culture and environment in western civilization during the nineteenth century’, in Bailes, *Environmental history*, pp. 46–57; see also Powell, ‘Historical geographies’, p. 179.

⁵⁷ H. J. Fleure, *Human geography in Western Europe*, Williams and Norgate, n.p., 1918.

humanity was constrained by the environment but was also a ‘geographical factor’ with the capacity to alter nature and to create ‘a new natural economy’; this approach restored nature to historical analysis in a way that Worster would later advocate.⁵⁸

In the *Annales* School, seminal works of environmental history were produced by French historians: Febvre, Bloch and Braudel. Febvre’s social history argued for the transformative agency of humans on the French environment, Bloch studied the history of rural life in France and the transformation of those landscapes, and Braudel produced a history of the Mediterranean region that emphasised long-term interactions between human activity and environmental changes.⁵⁹ These works represented a tradition of environmental history that developed independently of the work of British and American historical geographers; they also anticipated the work of Le Roy Ladurie, who provided a definition of the sub-discipline in 1974. Le Roy Ladurie linked environmental history with ecological history, and he emphasised the themes of industrial development and urbanisation, although he also investigated the history of social relations in rural France and their environmental impacts.⁶⁰ Overall, the work of the French geographers and of the historians of the *Annales* School represents a distinct tradition of environmental history that evolved separately from the work of British and American geographers (Figure 2.3).

Alongside those developing traditions, environmental history was also emerging within the American discipline of history (Figure 2.3). Ideas about environmental history developed in the ‘frontier school’ and in conservation history: the former examined the history of the spread of European settlement in North America; the latter investigated the development of environmental protection. These subsets of American history formed the tradition in which the sub-discipline of environmental history was later defined by Nash. Within that tradition, one seminal work of environmental history was

⁵⁸ P. Vidal de la Blache, *Principles of human geography*, ed. E. de Martonne, trans. M. T. Bingham, Constable and Co., London, 1926, pp. 18 and 23; H. J. Fleure, ‘Preface’, in Vidal de la Blache, *Personnalité géographique*, pp. v-xv; Worster, ‘History as natural history’.

⁵⁹ L. Febvre, *A geographical introduction to history*, trans. E. G. Mountford and J. H. Paxton, Kegan Paul, London, 1932; M. Bloch, *French rural history: an essay on its basic characteristics*, tr. J. Sondheimer, Routledge and Kegan Paul, London, 1966; F. Braudel, *The Mediterranean and the Mediterranean world in the age of Philip II*, trans. S. Reynolds, Harper and Row, London, 1972.

⁶⁰ E. Le Roy Ladurie, ‘Environnement et histoire’, *Annales: Economies, Sociétés, Civilisations*, Vol. 29, 1974, pp. 537–647, p. 537; E. Le Roy Ladurie, *The peasants of Languedoc*, trans. J. Day, University of Illinois Press, Urbana, 1969.

the history of the Great Plains, by Webb, which acknowledged the connection between settlement and pastoral development in that environment. Webb argued that the transformation of the plains contained profound significance for the settlers; he also argued that the interactions between land and society were reciprocal and, in doing so, he anticipated many of the concerns of modern environmental historians.⁶¹ Another seminal work was the history of the North American grasslands, by Malin, which showed that conceptions of nature as being stable, and of humans disturbing a state of equilibrium, were false. Malin also challenged the assumption that all human progress degrades the environment, although he conceded that humans had transformed the grasslands; in contrast, Worster later argued that European settlement had altered the American grasslands with disastrous consequences.⁶²

Malin wrote in the context of an increasingly influential conservation movement in North America. One seminal text that contributed to the growth of this movement was written by the biologist and environmentalist, Leopold, who advocated an ethic of land care in which natural resources should be used responsibly.⁶³ He argued that land was not a commodity that could be traded, but a community of which human societies formed a part, and should be left without human interference wherever possible. Leopold also argued that human activities should not compromise the possibility of future yields: an early expression of sustainability. Therefore, Leopold combined ecology and history in a manner that anticipated the work of Worster. Leopold's ideas, in conjunction with the influential work of Carson, stimulated the environmental reform movement and, as a result, the sub-discipline of environmental history became influenced by environmentalism. Conservation themes were also found in the works by Dana, who investigated the history of American forest and range policy, and by Hays, who provided a history of the progressive conservation movement.⁶⁴

⁶¹ W. P. Webb, *The Great Plains*, Grosset and Dunlap, New York, 1931.

⁶² J. C. Malin, *The grassland of North America: prolegomena to its history, with addenda*, Peter Smith, Gloucester, 1967; Worster, *Nature's economy: a history of ecological ideas*, Cambridge University Press, Cambridge, 1977, p. 248.

⁶³ A. Leopold, *A sand country almanac: and sketches here and there*, Oxford University Press, Oxford, 1949.

⁶⁴ Worster, *Ends of the earth*; R. L. Carson, *Silent spring*, Houghton Mifflin, Boston, 1962; Tate, 'Problems of definition'; S. T. Dana, *Forest and range policy: its development in the United States*, McGraw-Hill, New York, 1956; S. P. Hays, *Conservation and the gospel of efficiency: the progressive conservation movement, 1890-1920*, Harvard University Press, Cambridge, Massachusetts, 1959.

These works were influenced by another key work of American history, by Turner, who also examined the history of the land as well as its settlers. He explored the meaning of the frontier for pioneers, arguing that the experience of settling the New World shaped American institutions and ideals – although Nash commented that Turner did not acknowledge that those ideals in turn shaped the landscape.⁶⁵ Nonetheless, Turner's study of the American frontier represents an evolving interest among American historians in treating landscape as an element in the story of cultural development. Turner's work was developed by Sauer and Malin; together, those studies allowed new perceptions of the human place in nature, and the concepts of 'frontier' and 'wilderness' became key ideas in human interpretations of nature. The impact of the experience of wilderness on the American frontier pioneers – and the subsequent, reactionary movement towards conservation and environmentalism – have been described by Nash, and wilderness remained an important theme in American environmental history.⁶⁶

The environmental histories by American historians – especially the studies by Turner, Webb, Malin and Hays that are shown in Figure 2.3 – represent the immediate precursors of the sub-discipline of environmental history. Those works demonstrate that the environment had not been overlooked by historians, and they revealed increasingly nuanced views of the connections between humans and nature; indeed, White argued, for some historians, the environment became a key element in the understanding of American culture.⁶⁷ These works also acknowledged the reciprocal relationships between landscapes and human societies: as settlers reached frontier lands and began to transform the landscape, their perceptions and values were changed by the same landscapes that were being transformed. Such themes were explored further when the sub-discipline of environmental history was defined.

2.3.3 *The emergence of the sub-discipline of environmental history*

In 1970, environmental history was defined as a subset of American history by Nash, who argued that, in North America, the human transformation of nature was complete:

⁶⁵ F. J. Turner, 'The significance of the frontier in American history', in R. A. Billington (ed), *Frontier and selection: selected essays of Frederick Jackson Turner*, Prentice-Hall, Englewood Cliffs, 1961, pp. 11-27; Nash, 'State of environmental history'.

⁶⁶ Sauer, Morphology of landscape; Malin; *Grassland of North America*; R. Nash, *Wilderness and the American mind*, 3rd edn, Yale University Press, New Haven, 1982.

⁶⁷ White, 'American environmental history'.

even the survival of uncultivated places reflected human decisions and values, including the desire to preserve areas of wilderness (Figure 2.4). Nash regarded the entire landscape as a historical document upon which a record of human activities and attitudes towards the natural world was inscribed. He stated that the condition of the land ‘reflects the thought and culture of a people just as clearly as orthodox written evidence’; therefore, he argued, it is possible to ‘read’ the landscape and to discern past social values – this act constitutes environmental history.⁶⁸ For Nash, environmental history encompassed the whole range of human contact with nature, including all of the ways in which humans left a record of their actions in the landscape. He regarded Marsh as one of the first authors to treat the environment as a historical document and he acknowledged Marsh’s influence on Thomas *et al.*, but he argued that those studies described ‘man’s [sic] modification of the earth from the point of view of the earth; they stop short of asking what the modification of the environment tells about man and his ideas.’⁶⁹ Instead, he argued, the sub-discipline should be concerned with historical and perceptual geography, the preservation of wilderness, and the use of sources from literature, art and folk traditions.

The emergence of the sub-discipline took place in a context of increasing environmentalism: the rise of popular environmental movements, the United Nations Conference of the Human Environment in 1972, and the establishment of the United Nations Environment Program. In addition, structuralist and humanistic approaches increasingly offered critiques of scientific positivism, and the value of contributions from the humanities and social sciences to the production of environmental knowledge was acknowledged. In 1972, an issue of *Pacific Historical Review* was devoted to environmental history, including studies of the wilderness movement and conservation historiography.⁷⁰ All of the studies described American environments, and American environmental history was declared a ‘new teaching frontier’ by Nash. The next work of environmental history, by Petulla, also considered the beginning of the conservation movement and stated that considerable changes had occurred in American environments

⁶⁸ Nash, ‘State of environmental history’, p. 249.

⁶⁹ Nash, ‘State of environmental history’, p. 252; Thomas *et al.*, *Man’s role*.

⁷⁰ M. McCloskey, ‘Wilderness movement at the crossroads, 1945-1970’, *Pacific Historical Review*, Vol. 41, 1972, pp. 346-361; L. Rakestraw, ‘Conservation historiography: an assessment’, *Pacific Historical Review*, Vol. 41, 1972, pp. 271-288.

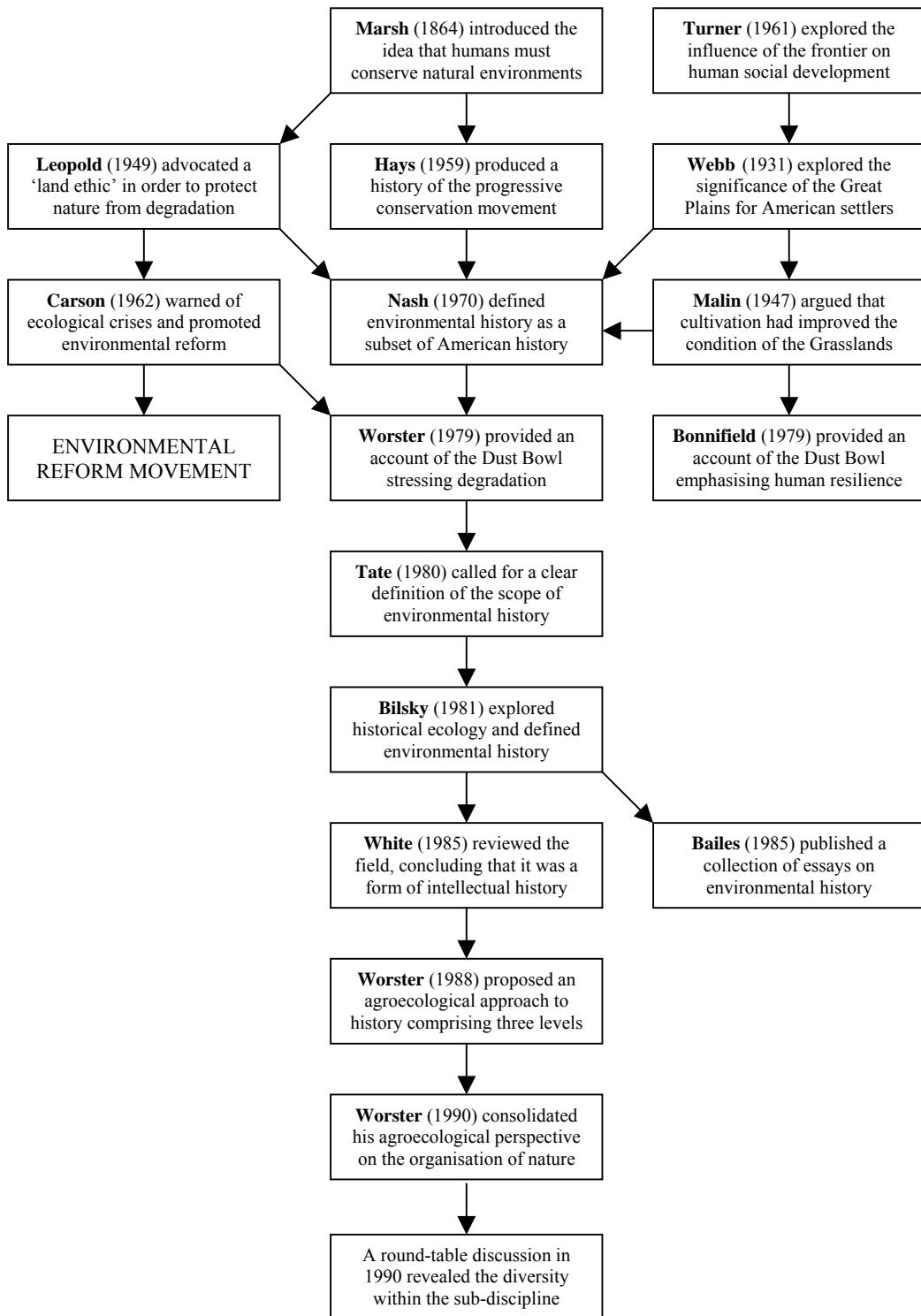


Figure 2.4. The evolution of the American sub-discipline of environmental history.

environment since European settlement.⁷¹ Subsequently, in 1979, other important works of environmental history were produced: Meinig described the interaction of natural and human factors in producing the landscape of resource use in Texas; and the two accounts of American Dust Bowl, by Bonnifield and Worster, were also published. The differences between the last two works are important as they inform Cronon's narrative approach to environmental history (Section 2.2.3).⁷²

In 1980, a collection of environmental histories was compiled by Bilsky, in which Moneyhon stated that the sub-discipline provided 'a means of comparing a broad range of past ecological crises and of looking for relationships between the events of the past and the current world crisis'.⁷³ In addition, Bilsky stated:

Man's [sic] relationship to his environment is not merely a unidirectional one, whereby he imposes his will upon the natural world; it is, instead, one of mutuality in which human behaviour is also profoundly affected by natural forces.⁷⁴

In this work, Bilsky introduced to environmental history the important idea of reciprocal interactions between humans and nature. Unusually, the same collection also included one marine environmental history, by Lewis, which considered the history of ecology and the sea in medieval times (between 300-1500 A.D.) in seven marine areas of Europe and North Africa; Lewis also suggested that other valuable marine environmental histories could be written.⁷⁵

The next statement about the sub-discipline was provided by Tate, who regarded environmental history as part of the fragmentation of history into many smaller fields. He noted the links between environmental history and the environmental movement, which he argued had led to excessive advocacy; instead, he claimed, a range of interactions between humans and nature existed in every historical period. Tate widened

⁷¹ R. Nash, 'American environmental history: a new teaching frontier', *Pacific Historical Review*, Vol. 41, 1972, pp. 362-372, p. 362; J. M. Petulla, *American environmental history: the exploitation and conservation of natural resources*, Boyd and Fraser, San Francisco, 1977, p. 382.

⁷² D. W. Meinig, *Imperial Texas: an interpretive essay in cultural geography*, University of Texas Press, Austin, Texas, 1979; Bonnifield, *Dust Bowl*; Worster, *Dust Bowl*; Cronon, 'A place for stories'.

⁷³ C. H. Moneyhon, 'Introduction', in Bilsky, *Historical ecology*, pp. 3-4, p. 4.

⁷⁴ Bilsky, 'Introduction', p. 8.

⁷⁵ A. R. Lewis, 'Ecology and the sea in medieval times (300-1500 A.D.)', in Bilsky, *Historical ecology*, pp. 74-85.

the sub-discipline to include the whole range of human responses to nature: all history could be regarded as having an environmental dimension. Environmental history faced the challenge of understanding human-environment relationships more precisely while accepting that nature was ‘increasingly absorbed in culture’.⁷⁶ He outlined four dimensions of environmental history: environmental perceptions and meanings, historical uses of technology, ecological theory and methods, and environmental regulatory mechanisms.

Tate’s work was followed by that of Worster, who considered ‘the long-running human dialogue with the earth’, and who called for the inclusion of an ecological perspective within history.⁷⁷ Worster stated that:

the natural environment is not really passive but rather is a powerful determining force throughout history. People are forever struggling with the land in an ongoing ecological dialectic [...]. The earth gets changed in the unfolding dialectic, but so do the people.⁷⁸

Worster proposed a ‘new environmental history’ that would consider the ecological bases of culture; however, because cultures contain complex power relations, Worster identified four areas for materialist analyses: the growth of industrial capitalism, the transformation of food production, the migration of frontiers, and the regulation of environmental exploitation. He argued that a materialist approach was necessary because ‘history was made by people who were creatures of nature, through their work and their modes of production’.⁷⁹

Worster argued that more attention to historical complexity and to materialist interpretation was required in the sub-discipline. He proposed an international focus for environmental history rather than an emphasis on North America because, compared with other traditions of environmental history in Britain and France, the American sub-discipline lacked pre-modern and regional studies, and it placed excessive emphasis on conservation history.⁸⁰ Worster’s comments were published in a collection, edited by

⁷⁶ Tate, ‘Problems of definition’, pp. 8-9.

⁷⁷ Worster, ‘History as natural history’, pp. 1-2.

⁷⁸ Worster, ‘History as natural history’, p. 5.

⁷⁹ Worster, ‘History as natural history’, p. 9.

⁸⁰ D. Worster, ‘World without borders: the internationalizing of environmental history’, in Bailes, *Environmental history*, pp. 661-669.

Bailes, that broadened the field from its concern only with histories of American landscapes to consider more widespread ‘historical aspects of the relationship between human beings and the rest of nature’. Specifically, Bailes believed that environmental history was concerned with four themes: changing values and attitudes towards nature, interactions between human economic activity and nature, histories of the conservation and environmentalist movements, and the role of professionals in altering nature and influencing environmental thought. Bailes argued for a combination of the methodologies of historians and ecologists: an approach that Opie called ‘dual literacy’.⁸¹

In 1985, White provided an important review of the sub-discipline, which he regarded as an extension of established themes in the literature of American historiography; specifically, he stated that environmental history ‘initially represented largely the political and intellectual history of the environmental movement and its predecessor, the conservation movement.’⁸² White acknowledged the anticipations of the sub-discipline found in the works by Turner, Webb, Malin and Hays. Yet he argued that many other studies – of government and professional organisations, utilitarian conservation, histories of art and literature, intellectual history, biography and National Park policy – had widened the scope of the sub-discipline. Most importantly, White argued, environmental historians such as Crosby, Worster and Merchant had used an ecological perspective in their works, and their influence was a distinctive feature of modern environmental history.⁸³ White argued that environmental historians had neglected urban environments; but, in addition, marine and coastal environments were entirely overlooked – even in White’s review.

The sub-discipline was developed extensively in a key work by Worster that provided the basis from which many recent directions have emerged.⁸⁴ In this work, Worster stated that environmental history concerns the role and place of nature in human life. He

⁸¹ Bailes, *Environmental history*, pp. 1 and 4; Opie, ‘Environmental history’, p. 34.

⁸² White, ‘American environmental history’, pp. 299-300.

⁸³ Webb, *Great Plains*; Malin, *Grassland of North America*; Hays, *Conservation and the gospel of efficiency*; Turner, ‘Significance of the frontier’; A. W. Crosby, *The Columbian exchange: biological and cultural consequences of 1492*, Greenwood Press, Westport, Connecticut, 1972; Worster, *Nature’s economy*; C. Merchant, *The death of nature: women, ecology, and the scientific revolution*, Harper and Row, San Francisco, 1980.

⁸⁴ Worster, *Ends of the Earth*.

suggested that ecology could provide insights into modes of production, food procurement, the rise of dominant societies, the roles of industrialism and capitalism, and the ecological consequences of modernity; the three levels of environmental history that he proposed have been discussed in Section 2.2.3 and are also summarised in Table 2.4. Worster did not include the built environment in his approach, which he argued comprised a ‘second nature’; his approach was also essentialist in its distinction between human and natural realms. Such essentialism has since been challenged by authors such as Cronon, Merchant, and Demeritt; nonetheless, Worster’s work was influential; his agroecological approach re-defined environmental history and organised the diverse strands of the sub-discipline around a conceptual focus; his ideas were also developed in a subsequent, theoretical work of environmental history (Figure 2.4).⁸⁵ The recent directions that emerged in response to Worster’s work are discussed below.

2.3.4 Recent directions in environmental history

Worster’s agroecological approach has received extensive review and criticism. An important roundtable debate was published in the *Journal of American History*, in 1990, in which diverse positions emerged – all of which were critical of some aspects of Worster’s approach (Figure 2.5).⁸⁶ White argued that Worster’s emphasis on food production was too narrow: it ignored the non-capitalist types of agriculture that have characterised most human food procurement throughout history. White also accused Worster of modelling the field at a much larger scale than the geographically-limited studies of practitioners, and also of neglecting the importance of values and beliefs in his portrayal of the success of European expansion.⁸⁷ Importantly, White argued that Worster neglected the complexity of causal factors: human impacts are difficult to identify because ecosystems are characterised by instability and constant change; his observation applies equally to the reconstruction of human impacts in the Great Barrier Reef.

⁸⁵ Worster, ‘Appendix’, pp. 292-293; Cronon, ‘Modes of prophecy’; C. Merchant, *Radical ecology: the search for a livable world*, Routledge, New York, 1992; Demeritt, ‘Ecology, objectivity and critique’; Worster, ‘Transformations of the Earth’.

⁸⁶ Cronon, ‘Modes of prophecy’; C. Merchant, ‘Gender and environmental history’, *Journal of American History*, Vol. 76, No. 4, 1990, pp. 1117-1121; S. J. Pyne, ‘Firestick history’, *Journal of American History*, Vol. 76, No. 4, 1990, pp. 1132-1141; R. White, ‘Environmental history, ecology, and meaning’, *Journal of American History*, Vol. 76, No. 4, 1990, pp. 1111-1116.

⁸⁷ White, ‘Environmental history’, p. 1113.

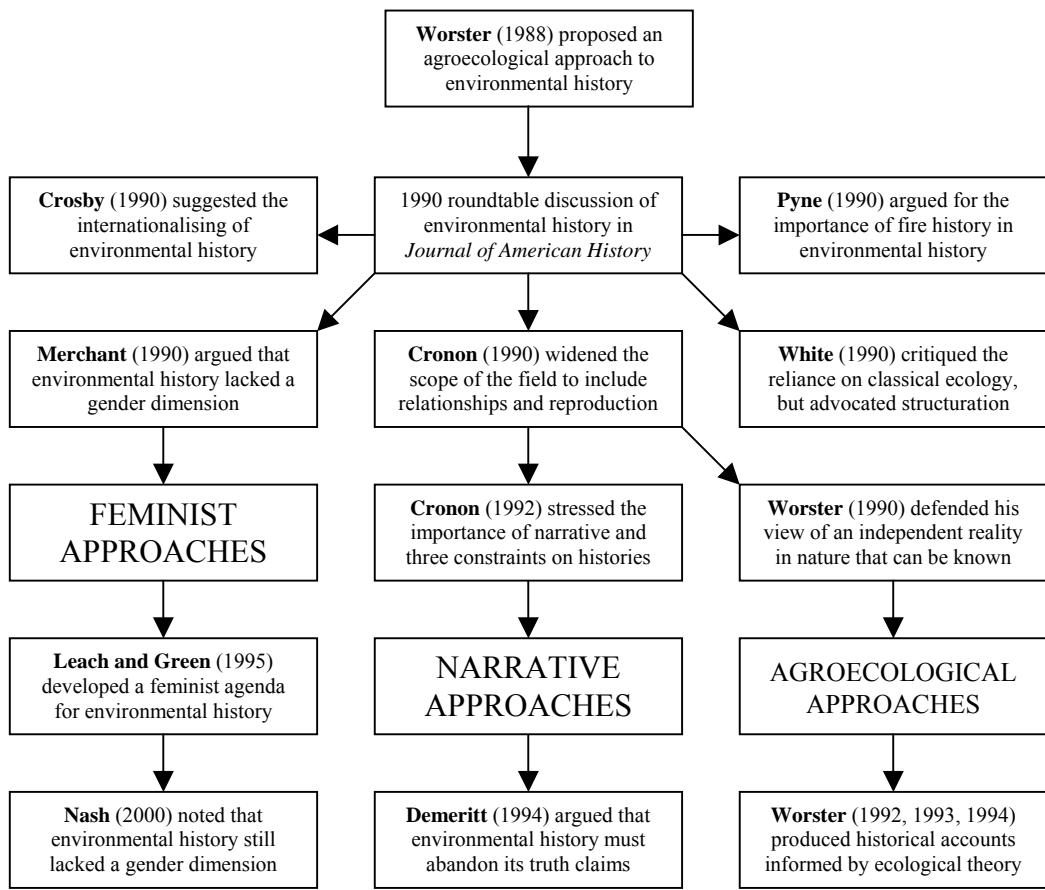


Figure 2.5. Some recent directions in environmental history.

Merchant argued that Worster's conception of the field lacked any gender analysis. Historically, women and men have played different roles in production and have related differently to the environment; hence, Merchant suggested the addition of a fourth level of inquiry to Worster's previous three: the analysis of reproduction. She stated that 'the way in which world views, myths, and perceptions are constructed by gender at the cognitive level can be made an integral part of environmental history.'⁸⁸ Merchant argued that this fourth level of analysis could be related to Worster's three levels in the following ways: first, humans reproduce biologically in relation to different cultural norms, demographic stages and resource bases; second, humans reproduce energy by procuring food, and so reproduce daily life; third, humans reproduce socially by communicating systems of governance, behaviour and skills. Therefore, Merchant argued, a focus on reproduction could reveal changes in the forms of patriarchy that have taken place in different societies and could inform richer environmental histories.

Cronon criticised Worster's narrow framework, arguing that more interesting forms of environmental history could be produced using different approaches.⁸⁹ However, Cronon noted that it was within Worster's third level of analysis – the mental constructs of environmental myths, meanings and regulations – that scholars had contributed most to the field of environmental history. He argued that environmental historians should focus on the critical relationships between particular groups and their ecosystems in particular historical contexts, and that conflicts between social groups could reveal different ways of interacting with nature; but he stated that environmental historians must also 'probe below the level of the group to explore the implications of social divisions for environmental change' and to avoid re-telling the same narrative of capitalist exploitation. Like White, Cronon disagreed with the use of problematic ecological concepts such as equilibrium, community and climax; he also argued that the term 'environmental damage' requires precise definition.⁹⁰

In response, Worster accused Cronon and Merchant of reducing environmental history to social history, and he argued that replacing holism with particularism –particular interactions between humans and nature in particular places' – reflects a postmodern

⁸⁸ Merchant, 'Gender and environmental history', p. 1119; see also p. 1120.

⁸⁹ Cronon, 'Modes of prophecy', p. 1123.

⁹⁰ Cronon, 'Modes of prophecy', pp. 1126 and 1128-1129.

fear of generalisation and ignores global human impacts.⁹¹ He suggested that environmental historians should focus on larger-scale human-environment relationships: collective stories and institutions of civilisations, dynamics of empires, and the planet's future. He stated: 'One of humankind's oldest intuitions is that the realm of nature has an objective, independent order and coherence', which humans should understand and respect; for Worster, the purpose of environmental history is to restore to historical studies a sense of 'the coherence, pattern and integrity of nature' in which human history belongs.⁹²

The 1990 debate surrounding Worster's agroecological approach organised the themes that would develop in environmental history during the following decade (Figure 2.5). The field diversified as some environmental historians maintained essentialist views and others adopted postmodern critical theory. In the first category belong many scientific reconstructions of environmental change; in the second are found qualitative environmental histories, and examples of each type are discussed below. However, many studies do not belong strictly in either category, nor do they explicitly adopt either position. This has resulted in a range of environmental histories in which the categories of 'human' and 'nature' have been defined variously as objective realities, as social constructions, or not at all. Consequently, White argued in 2001 that the sub-discipline still lacked a conceptual centre.⁹³

Some environmental historians have continued to use ecological models in reconstructing past biophysical environments; hence, those scientific studies are very different from other historical narratives. The former include the detailed collection by Turner *et al.*, which contains scientific accounts of many changes in human population, societies, land, water, atmosphere, biota and biochemistry; although, despite its scientific emphasis, the work also explored cultural ecology, social relations and discourses of meaning.⁹⁴ That collection considered the comparatively short historical perspective of the last 300 years; during that period, Holdgate argued, the human-

⁹¹ D. Worster, 'Seeing beyond culture', *Journal of American History*, Vol. 76, No. 4, 1990, pp. 1142-1147, p. 1143.

⁹² Worster, 'Seeing beyond culture', pp. 1146-1147.

⁹³ White, 'Afterword'; Hays, 'Toward integration', also called for greater integration in environmental history scholarship.

⁹⁴ B. L. Turner *et al.* (eds), *The earth as transformed by human action: global and regional changes in the biosphere over the past 300 years*, Cambridge University Press, Cambridge, 1990.

environment relationship was re-defined and many environmental changes accelerated. Yet, in general, as Driver and Chapman acknowledged, scientific accounts have neglected the historical contexts of environmental systems; most scientific works that have reconstructed past environments have used physical and chemical modelling techniques, including general circulation models, remote sensing techniques and geoarchaeological methods.⁹⁵

Nonetheless, extensive scientific reconstruction of past environment changes has occurred – particularly for the Quaternary period – and detailed scientific time series have been produced that describe considerable environmental changes during the last 2 million years. Examples of accounts describing global environmental changes are the works by Mannion, Lowe and Walker, Roberts, and Bell and Walker.⁹⁶ Mannion's account described environmental changes during the last 3 million years and she reconstructed Quaternary environments using an array of scientific and historical approaches. Roberts produced a similar type of scientific environmental history, although one focusing on the shorter time scale of the Holocene; he also used a combination of palaeoecological and historical methods to reconstruct past environments. The studies by Lowe and Walker, and by Bell and Walker, in contrast, placed more emphasis on scientific methods of reconstructing past environments. Another study using a similar approach, but which focused on one aspect of the global ecosystem, by Jackson *et al.* of, reconstructed historical over-fishing in coastal ecosystems; that study suggested that considerable depletion of marine species has taken place during the historical period. Another study of this type, by Nunn, combined scientific data with oral history evidence to reconstruct coastal changes in two Fijian islands during the last 200 years.⁹⁷

⁹⁵ M. Holdgate, 'Postscript', in Turner *et al.* (eds), *Earth as transformed by human action*, pp. 703-706; T. S. Driver and G. P. Chapman (eds), *Timescales and environmental change*, Routledge, London, 1996.

⁹⁶ A. M. Mannion, *Global environmental change: a natural and cultural environmental history*, Longman, Harlow, 1991; J. J. Lowe and M. J. C. Walker, *Reconstructing Quaternary environments*, 2nd edn, Pearson, Harlow, 1997; N. Roberts, *The Holocene: an environmental history*, 2nd edn, Blackwell, Oxford, 1998; M. Bell and M. J. C. Walker, *Late Quaternary environmental change: physical and human perspectives*, 2nd edn, Pearson, Harlow, 2005, p. 16.

⁹⁷ Jackson *et al.*, 'Historical overfishing', p. 629; P. D. Nunn, 'Coastal changes over the past 200 years around Ovalau and Moturiki Islands, Fiji: implications for coastal zone management', *Australian Geographer*, Vol. 31, No. 1, 2000, pp. 21-39.

Another recent direction in environmental history includes works which, although not explicitly scientific in their approach, continue to use ecological theory. These studies include several ecological histories by Worster and two collections of studies edited by Dovers; the latter are reviewed in Section 2.4. Dovers claimed that, while some attention has been paid to historical analysis in the physical and biological sciences, this has rarely been consistent nor has explored the interrelationships between human and natural systems.⁹⁸ Attempts to integrate historical and scientific approaches, however, face considerable difficulties: the choice of appropriate time-scales, scarcity of historical data for many geographical areas, and postmodern challenges about the validity of using some ecological concepts.

A different direction in environmental history is found in the literature of historical geography (Figure 2.5), which includes Crosby's study of the biological expansion of Europe between 900 and 1900 – a process he described as ecological imperialism – and which extended his earlier analysis of the impacts of European settlement in North America. Another work of this type is the study, by Williams, which investigated the clearance of forests in America since pre-European times and the re-growth of these forests in the twentieth century, and which indicated that forest clearance has been the single most important change in the American landscape. A further example of this type of study is Whitney's analysis of environmental change in temperate North America since 1500. Whitney concluded that European settlement dramatically altered the ecology of North America; but, because many of those changes took place before historical records were kept, the long-term impacts of the European settlement of the region were still unknown.⁹⁹ Similar difficulties hinder the reconstruction of the earliest European fisheries in the Great Barrier Reef, for which production statistics were not published (Sections 5.3.1 and 5.3.2).

⁹⁸ D. Worster, *Under western skies: nature and history in the American west*, Oxford University Press, New York, 1992; Worster, *Wealth of nature*; S. Dovers (ed), *Australian environmental history: essays and cases*, Oxford University Press, South Melbourne, 1994; S. Dovers (ed), *Environmental history and policy: still settling Australia*, Oxford University Press, South Melbourne, 2000; Dovers, 'Australian environmental history', pp. 4-5.

⁹⁹ A. W. Crosby, *Ecological imperialism: the biological expansion of Europe, 900-1900*, Cambridge University Press, Cambridge, 1986; Crosby, *Columbian exchange*; M. Williams, *Americans and their forests: a historical geography*, Cambridge University Press, Cambridge, 1989, p. xvii; G. G. Whitney, *From coastal wilderness to fruited plain: a history of environmental change in temperate North America from 1500 to the present*, Cambridge University Press, Cambridge, 1994.

Yet some studies do not belong clearly within either historical geography or environmental history: considerable overlap exists between those sub-disciplines. For example, works by Simmons include both environmental history and historical geography, and consider both ecological changes and cultural constructions of the environment.¹⁰⁰ Both Baker and Williams discussed the relationship between those sub-disciplines, claiming that many environmental history studies were in fact produced by historical geographers, and arguing that both sub-disciplines investigate changing society-environment relationships, especially during the transition from traditional to industrial societies. Colten also acknowledged the convergence between environmental history and historical geography, and he advocated the use of the term ‘environmental historical geography’ for their common focus. Such a convergence between environmental history and historical geography was demonstrated in two studies by Williams – forest histories for the period 1900-1950, and for prior to 1500, respectively – in which the terms were used almost synonymously.¹⁰¹ Environmental histories produced within historical geography are distinctive in their spatial – and often regional – approach to environmental changes; hence, they form a subset of the sub-discipline of environmental history.

Environmental histories based on scientific techniques, ecological theory or historical geography can be contrasted with other approaches that have used postmodern critical theory. Postmodern approaches comprise a different, complex set of directions within the sub-discipline, including feminist and narrative approaches (Figure 2.5). These works reject the essentialism of scientific and agroecological approaches, arguing instead that all categories of thought are socially constructed; furthermore, those categories reflect and reproduce complex power relations. Postmodern scholars share a concern with cultural representations and consider that categories of thought are themselves texts that can be ‘read’, interpreted and deconstructed. However, postmodern scholars argue that no particular narrative should be privileged, and that overarching ‘meta-narratives’ are illusory. Therefore, postmodern environmental historians do not attempt to provide definitive reconstructions of past environments,

¹⁰⁰ Simmons, *Environmental history*; Simmons, *Interpreting nature*.

¹⁰¹ A. R. H. Baker, ‘Historical geography and environmental history’, *Journal of Historical Geography*, Vol. 20, No. 1, 1994, pp. 1-2; Williams, ‘Relations of environmental history’, p. 15; C. E. Colten, ‘Historical geography and environmental history’, *The Geographical Review*, Vol. 88, No. 2, 1998, pp. iii-iv, p. iii; Williams, ‘End of modern history?’; Williams, ‘Dark ages and dark areas’.

because they regard such attempts as invalid. Instead, reconstructions of the past are regarded merely as representations that are viewed through particular cultural lenses.¹⁰² Consequently, many postmodern narratives of environmental history exist, none of which can claim to be definitive.

Feminist environmental histories are exemplified by the works of Merchant, who described the ‘death of nature’: the ways in which nature has been increasingly viewed as mechanical and subsequently exploited; and who also investigated the roles of women in the construction and reproduction of changing meanings of nature. In particular, Merchant argued, attention should be given to the ways in which gender has influenced the use, perception and reproduction of the environment.¹⁰³ Other authors also provided feminist critiques of the sub-discipline: Leach and Green described the scope of a gendered environmental history, and Nash argued for a gendered environmental history that focuses on ‘the mutuality *and* distinctiveness of the human and non-human realms.’¹⁰⁴ These authors argued that the histories of the interactions of women and men with nature are particular and diverse.

Narrative approaches represent another postmodern direction within the sub-discipline. These approaches contrast with environmental histories based on ecology and have been developed in the influential works by Cronon and Demeritt, although they contain significant philosophical differences.¹⁰⁵ Cronon’s approach forms the basis of my research, and his definition of environmental history has been discussed in Section 2.2.3. His work is important because it provides an approach to environmental history that is significantly different from the agroecological approach of Worster, and which allows for a philosophical engagement with postmodern critical theory within environmental history. Most distinctively, Cronon identified the position of the narrator as a crucial factor in environmental history, and he argued that environmental histories

¹⁰² Cultural constructions of the environment are discussed by T. Ingold, ‘Culture and the perception of the environment’, in E. Croll and D. E. Parkin (eds), *Bush base: forest farm: culture, environment and development*, Routledge, London, 1992, pp. 39–56; Demeritt, ‘Ecology, objectivity and critique’.

¹⁰³ Merchant, *Death of nature*, p. 9; Merchant, *Radical ecology*; C. Merchant, *Earthcare: women and the environment*, Routledge, New York, 1995; Merchant, ‘Gender and environmental history’.

¹⁰⁴ M. Leach and C. Green, *Gender and environmental history: moving beyond the narratives of the past in contemporary woman-environment policy debates*, Institute of Development Studies, London, 1995, emphasis in original; Nash, ‘Environmental history’, p. 27.

¹⁰⁵ Cronon, ‘Modes of prophecy’; Cronon, ‘A place for stories’; Cronon, ‘Cutting loose or running aground?’; Demeritt, ‘Ecology, objectivity and critique’.

are shaped by plots that may be optimistic or tragic; hence, environmental histories are themselves social constructions.

That view, however, was challenged by Demeritt, who argued that Cronon did not explore the full implications of his view of narrative.¹⁰⁶ While Cronon suggested that humans could not know the truth about nature except through the constructions of narrative, Demeritt argued that no objectively-known world exists to which narratives could conform. Instead, humans must accept that nature is entirely a human construction, and should fashion it in the most desirable ways; public discourse can guide historians in judging whether impacts have been desirable or not, but environmental historians cannot measure the ecological consequences of human actions. Cronon responded that environmental historians accept social constructivist ideas, but are also realists. He stated that, although nature has been moulded by human activities and imaginations, ‘it is not *entirely* our own invention.’¹⁰⁷ Cronon challenged Demeritt’s view that there is no possibility of knowing a nature that humans have not created, arguing instead that environmental historians must work with the paradox that human narratives shape human experiences of nature, but do not produce that reality.

Modern environmental history, therefore, is a diverse, contested academic field; its diversity is apparent in the extensive *Encyclopedia of world environmental history*, edited by Krech *et al.*, which claims to represent the work of a ‘global community of scholars’.¹⁰⁸ Scientific, historical and geographical approaches have given rise to different environmental histories, and postmodern approaches have introduced new theoretical complexity to the sub-discipline. Some of the tensions arising from the use of different approaches by environmental historians, including the problematic use of ecological concepts, have been acknowledged by Pawson and Dovers.¹⁰⁹ Yet, despite the significant differences in approach between scholars, most environmental histories investigate the reciprocal interactions between humans and the environment through time. Yet in spite of the development of new approaches, the sub-discipline has retained a bias towards American landscapes, which Crosby argued resulted from conservatism

¹⁰⁶ Demeritt, ‘Ecology, objectivity and critique’.

¹⁰⁷ Cronon, ‘Cutting loose or running aground?’, p. 40, emphasis in original.

¹⁰⁸ S. Krech *et al.* (eds), *Encyclopedia of world environmental history*, 3 Vols, Routledge, New York, 2003, p. ix.

¹⁰⁹ Pawson and Dovers, ‘Environmental history’, p. 63.

during the formative period of the sub-discipline, between 1970 and 1985.¹¹⁰ Instead, Crosby advocated the internationalising of the sub-discipline, and recent environmental histories have been written for many other parts of the world, including the Amazon, the Pacific region, Scandinavia and New Zealand.¹¹¹

Apart from its North American bias, another recurrent issue in the sub-discipline has been its connection with environmentalism, as acknowledged by several scholars.¹¹² Many positions towards environmentalism now exist within the sub-discipline. Narratives of accelerating environmental degradation are exemplified by a work by Hughes, who argued that environmental history must consider global human impacts such as deforestation and climate change. Lowenthal shared his environmentalist concerns, arguing that environmental issues still require historical contexts, and Norwood lamented the increasing polarity between social and ecological environments.¹¹³ In contrast, I did not adopt a position of environmental advocacy from the outset, particularly as Cronon has shown that, in doing so, environmental historians may simply draw the conclusions they expect.

My research uses Cronon's approach, which argues that environmental history is the production of a historical narrative, containing a plot that may be optimistic or tragic. His approach is concerned with the interactions between humans and the environment below the group level: a view that is well suited to the use of oral history interviews with individual informants.¹¹⁴ Furthermore, Cronon's approach acknowledges that all histories are produced by storytellers. The environmental history of the Great Barrier Reef represents a complex story of many interactions between humans, coral reefs, islands and marine wildlife species. Yet Cronon acknowledged one danger of postmodern approaches: they can reduce the central concern of environmental historians – the history of human-environment interactions – to an entirely mental construct.

¹¹⁰ Terrie, 'Recent work in environmental history'; Crosby, 'Past and present'; Miller, 'An open field'.

¹¹¹ For example, D. Cleary, 'Towards an environmental history of the Amazon: from prehistory to the nineteenth century', *Latin American Research Review*, Vol. 36, No. 2, 2001, pp. 65-97; McNeill, *Environmental history in the Pacific world*; T. Myllyntaus and M. Saikku (eds), *Encountering the past in nature: essays in environmental history*, 2nd edn, Ohio University Press, Athens, Ohio, 2001; E. Pawson and T. Brooking, *Environmental histories of New Zealand*, Oxford University Press, South Melbourne, 2002.

¹¹² See, for example, Hughes, 'Global dimensions'; Lowenthal, 'Environmental history'.

¹¹³ Hughes, 'Global dimensions'; Lowenthal, 'Environmental history'; Norwood, 'Disturbed landscape/disturbing processes'.

¹¹⁴ Cronon, 'A place for stories'; Cronon, 'Cutting loose or running aground?'.

Worster argued that not all environmental changes are anthropogenic; his qualification is accepted in my research.¹¹⁵ Yet the Great Barrier Reef has been significantly influenced by human activity since European settlement and those impacts require detailed, contextual description – however difficult the delineation of anthropogenic and natural changes may be.

Thus in the sub-discipline of environmental history those material, ecological changes that have taken place as a result of interactions between humans and nature are interpreted and represented as narratives. Such a process of interpretation has long been familiar to historians, for whom, Fitzgerald stated: ‘All history is a story, told from the point of view of the present.’¹¹⁶ However, stories about changes in the environment are most effective if they engage with universal concerns; one way in which those stories can do so is to inform policy, as Powell acknowledged:

The best environmental stories address universals – our human needs for security, comfort, identity, the calming of conscience and its concomitant firm purpose of amendment – but also recognize locational integrities in so far as they have a very definite resonance in those national and regional contexts in which modern communities expect to participate in the making and breaking of government policy.¹¹⁷

Consequently, in my research, I have produced three narratives of environmental changes in the corals, islands and marine wildlife species, respectively, of the Great Barrier Reef (Chapters 5-7), and I have also derived implications of those stories for the contemporary management of the GBRWHA (Chapter 8).

2.4 Australian environmental histories

In contrast to the many works of environmental history concerned with North American environments, Australian studies contain distinctive themes that relate to diverse Australian environments and to the particular settlement history of this country; in doing so, Australian scholars have made important contributions to the sub-discipline of

¹¹⁵ Cronon, ‘Cutting loose or running aground?’; Worster, ‘Appendix’.

¹¹⁶ R. Fitzgerald, *From the Dreaming to 1915: a history of Queensland*, UQ Press, St. Lucia, Queensland, 1982, p. xv.

¹¹⁷ Powell, ‘Historical geographies’, pp. 186-187.

environmental history.¹¹⁸ Marsh argued that the comparatively recent colonisation of Australia would allow the changing relationship between humans and nature to be documented; since Marsh, many scholars have investigated the ways in which Australian landscapes have been transformed by human activities.¹¹⁹ The academic field of Australian environmental history is now a diverse area of inquiry and some of that diversity is shown in Table 2.7, which lists a selection of exemplary works of Australian environmental history.

Australian environmental histories include works at continental, state-wide and regional (sub-national) scales; they also include many studies of specific topics such as forests, fire and water, which are distinguished in Table 2.7. Since accounts of Australian environmental history have been often produced within other sub-disciplines – particularly historical geography – many approach environmental changes from a spatial perspective; this overlap between the sub-disciplines of environmental history and historical geography has been discussed by Dovers and Dargavel, Powell, and Pawson and Dovers.¹²⁰ Many Australian environmental histories have focused on terrestrial environments in the south and east of the country: especially in New South Wales, South Australia and Victoria. Fewer studies of Queensland environments have been produced. The topics of, forests, soil and land degradation have been extensively studied; however, in contrast, marine and coastal environments have not received comparable attention from environmental historians.

2.4.1 Australian environmental histories at the continental scale

Some works have described environmental change in Australia at the continental scale (Table 2.7); those accounts include the geographical study of Australasia by Reclus, which described many environmental changes, including the introduction of cattle and exotic plant species.¹²¹ More recently, Keast has produced a general history of the Australian environment since the Tertiary period, and Taylor provided an account of

¹¹⁸ Powell, ‘Historical geography’.

¹¹⁹ Marsh, *Man and nature*.

¹²⁰ S. Dovers and J. Dargavel, ‘Environmental history – a confluence of disciplines’, *Australian Historical Society Bulletin*, 1991, pp. 25-30; J. M. Powell, ‘Strangers and lovers: disputing the legacy of environmental history’, in L. A. C. Dobrez (ed), *Identifying Australia in postmodern times*, Bibliotech, Canberra, 1994, pp. 87-103; Powell, ‘Historical geography’; Pawson and Dovers, ‘Environmental history’.

¹²¹ Reclus, *Australasia, passim*.

(a) SURVEYS CATEGORISED BY GEOGRAPHICAL SCALE

(i) <i>Continental scale</i>	(ii) <i>State-wide scale</i>	(iii) <i>Regional scale</i>
Reclus (c.1882)	Williams (1974)	Meinig (1962)
Keast (1959)	Whitelock (1985)	Bauer (1964)
Powell (1988)	Nance and Speight (1986)	Heathcote (1965)
Seddon and Davis (1976)	Johnston (1988)	Buxton (1967)
Frawley (1987, 1994)		Hancock (1972)
Lines (1991)		Rolls (1981)
Dovers (1994, 2000)		Dovers (1994)
Flannery (1994)		Fry (1994)
Rolls (1994, 1999, 2000)		Johnson (1994)
Griffiths and Robin (1997)		Lawrence (1994)
Archer <i>et al.</i> (1998)		Rosen (1995)
Young (2000)		Brunger and Selwood (1997)

(b) SURVEYS CATEGORISED BY TOPIC

(iv) <i>Vegetation histories</i>	(v) <i>Forest histories</i>	(vi) <i>Water histories</i>
Adamson and Fox (1982)	Frawley (1983, 1988, 1994)	Eyles (1977)
Smith (1982)	Birtles (1987, 1988)	Warner (1984)
Colhoun (1992)	Brennan (1988)	Gell and Stuart (1989)
White (1992)	Dargavel (many studies)	Powell (many studies)
Nix (1994)	Griffiths (1993, 2002)	Seddon (1994)
Benson and Redpath (1997)	Stubbs (1998)	Finlayson and Brizga (1995)
Lunt (1997)	Hill <i>et al.</i> (1998, 1999)	Rosen (1995)
McGrath and Boyd (1998)	Borschmann (1999)	Roberts and Sainty (2000)
(vii) <i>Soil histories</i>	(viii) <i>Fire histories</i>	(ix) <i>Fauna histories</i>
Holmes (1946)	Pyne (1990, 1991)	Matthams (1921)
Beale and Fray (1990)	Hill <i>et al.</i> (1999)	Rolls (1977)
Boucher and Powell (1994)	Hill <i>et al.</i> (2000)	Jarman (1992)
Rolls (1994)	Crowley and Garnett (2000)	Morton (1994)
Brunger and Selwood (1997)	Vigilante (2001)	
Nathan (1999)		
Letnic (2000)		
(x) <i>Coastal histories</i>	(xi) <i>Works using oral history</i>	
Bird (1978)	Sanders (1991)	
Bowen (1994)	Kennealy (1994)	
Arnold (1996)	Finlayson and Brizga (1995)	
Brown (1998)	Brunger and Selwood (1996)	
McLoughlin (1999, 2000)	Roberts and Sainty (2000)	
Haysom (2001)		
Bowen and Bowen (2002)		

Table 2.7. Some examples of works of Australian environmental history.

that included an overview of European settlement and environmental impacts in Australia.¹²² A subsequent collection of Australian environmental histories, edited by Rapoport, considered the human alteration of Australian ecosystems, changing European perceptions of the Australian landscape, attitudes towards environmental heritage, and conservation history. In 1974, a collection of studies of changing perceptions of the Australian environment was published, which included continental-scale overviews by Bolton, Davidson and Lowenthal.¹²³

In 1981, an important work of Australian history, by Bolton, was published; that text represented a rare work by an Australian historian that included environmental changes in its scope. The subtitle of that text, *Spoils and spoilers: Australians make their environment*, indicated that environmental changes formed an important part of Bolton's account; he described many impacts of European settlers on the Australian environment, including widespread forest clearance, closer settlement, agricultural practices, whaling and sealing, and the growth of cities.¹²⁴ Bolton's account was followed by a study of images of the Australian environment, produced by Frawley in 1987, which developed Heathcote's earlier study of perceptions of the Australian environment.¹²⁵ The following year, Powell's seminal study of Australian historical geography was published, which included accounts of environmental degradation, environmental management and environmentalism; that account represents an extensive discussion of changes in the Australian environment, and in human-environment relationships, since European settlement.¹²⁶ Nevertheless, the coverage of these seminal texts did not include the environmental history of the Great Barrier Reef.

¹²² A. Keast, 'Biogeography and ecology in Australia', in A. Keast *et al.* (eds), *Biogeography and ecology in Australia*, Dr. W. Junk, The Hague, 1959, pp. 15-35; G. Taylor, 'Human ecology in Australia', in A. Keast *et al.* (eds), *Biogeography and ecology in Australia*, Dr. W. Junk, The Hague, 1959, pp. 52-68.

¹²³ A. Rapoport (ed), *Australia as human setting*, Angus and Robertson, Sydney, 1972; G. Seddon and M. Davis (eds), *Man and landscape in Australia: towards an ecological vision*, Australian UNESCO Committee for Man and the Biosphere, Publication No. 2, Papers from a symposium held at the Australian Academy of Science, Canberra, 30 May-2 June 1974, AGPS, Canberra, 1976.

¹²⁴ G. Bolton, *Spoils and spoilers: Australians make their environment 1788-1914*, Allen and Unwin, Sydney, 1981.

¹²⁵ K. J. Frawley, *Exploring some Australian images of environment*, Working Paper 1987/1, Department of Geography and Oceanography, University College, Australian Defence Force Academy, Canberra, 1987; R. L. Heathcote, 'The visions of Australia, 1770-1970', in Rapoport (ed), *Australia as human setting*, pp. 77-98.

¹²⁶ J. M. Powell, *An historical geography of modern Australia: the restive fringe*, Cambridge University Press, Cambridge, 1988.

Other continental-scale works published since Powell's seminal text, in 1988, include two studies – by Lines and Young – that considered ecological impacts in Australia from positions of environmental advocacy. Lines acknowledged that the environmental history of Australia 'is essentially a political history and bears the stamp of human will, ideals and purposes'; Young also drew attention to the ethical dimension of environmental impacts in Australia and argued for the conservation of disturbed ecosystems.¹²⁷ Subsequently, a collection of continental-scale, Australian environmental histories was edited by Smith, which considered biodiversity in Australia, the natural history of Australian environments, impacts of Aboriginal and European Australians and the exploitation of water and mineral resources. That collection was followed by another, edited by Garden, which also discussed changes in the Australian environment in their historical context.¹²⁸

Another significant collection of Australian environmental histories was edited by Dovers, which contained reviews of the sub-discipline by Dovers and Frawley.¹²⁹ Dovers argued that the relationship between humans and the land had changed from sustainability to depletion and stated that 'contemporary resource and environmental management issues have a history, as does the total environment, the landscapes we dwell in.'¹³⁰ He argued that environmental history comprises the task of explaining this complex past and that, although environmental history should inform policy, it is also intrinsically valuable: there are good narratives to be told about changes in the Australian environment. In the same collection, a review by Gammage advocated the use of ecological baselines in order to measure the impacts of European settlers, but he acknowledged that the environmental history of the entire continent cannot be reconstructed; rather a mosaic of studies should be produced in order to illuminate particular relationships between humans and different environments. In contrast, Flannery attempted to reconstruct an environmental history for the entire continent since

¹²⁷ W. J. Lines, *Taming the Great South Land: a history of the conquest of nature in Australia*, Allen and Unwin, Sydney, 1991, p. 279; J. M. R. Young, *Sustaining the earth: the past, present and future of the green revolution*, New South Wales University Press, Kensington, New South Wales, 1991.

¹²⁸ J. Smith (ed), *The unique continent: an introductory reader in Australian environmental studies*, UQ Press, St. Lucia, Queensland, 1992; D. Garden (ed), *Created landscapes: historians and the environment*, comp. S. Hodges, Proceedings of the Historians and the Environment Conference, October 1992, History Institute, Victoria, Inc., Carlton, Victoria, 1993.

¹²⁹ Dovers, *Australian environmental history*; Dovers, 'Australian environmental history'; K. J. Frawley, 'Evolving visions: environmental management and nature conservation in Australia', in Dovers, *Australian environmental history*, pp. 55–78.

¹³⁰ Dovers, 'Introduction, review and principles', p. 3.

Gondwanan times, although Young acknowledged that Flannery's study represented a general account and some of the human impacts that were reconstructed in his study were supported by limited evidence.¹³¹

Rolls produced several accounts of Australian environmental history at the continental scale, based on qualitative sources including the records of early European explorers; his accounts describe extensive changes in the Australian landscape as a result of impacts by Indigenous Australians and European settlers: the creation of open country using fire, the introduction of new farming methods, closer settlement and land degradation.¹³² Benson and Redpath challenged some of the assumptions made by Rolls – and also by Flannery – and argued that many vegetation types were overlooked in those accounts; Benson and Redpath also argued that the records of early European explorers had been misinterpreted in those studies. In contrast, Best's colonial history of Australia focused only on the impacts of European settlers: the introduction of pests, soil erosion and vegetation change.¹³³ Another text, edited by Griffiths and Robin, offered an original, postcolonial perspective towards Australian environmental history; that collection covered many themes including the use of fire, the import of environmental ideas, imperial perceptions of the environment, early European exploration, and imperial environmental historiography. Griffiths argued that such a collection illustrated the ways in which environmental histories of settler societies could destabilise traditional narratives of world history.¹³⁴

¹³¹ B. Gammage, 'Sustainable damage: the environment and the future', in Dovers, *Australian environmental history*, pp. 258-267, p. 265; T. F. Flannery, *The future eaters: an ecological history of the Australasian lands and people*, Reed Books, Chatswood, New South Wales, 1994; A. R. M. Young, *Environmental change in Australia since 1788*, 2nd edn, Oxford University Press, South Melbourne, 2000.

¹³² E. C. Rolls, *They all ran wild: the story of pests on the land in Australia*, Angus and Robertson, Sydney, 1977; E. C. Rolls, *A million wild acres: 200 years of man and an Australian forest*, Nelson, Melbourne, 1981; E. C. Rolls, 'More a new planet than a new continent', in Dovers (ed), *Australian environmental history*, pp. 22-36; E. C. Rolls, 'Land of grass: the loss of Australia's grasslands', *Australian Geographical Studies*, Vol. 37, No. 3, 1999, pp. 197-213; E. C. Rolls, 'The end, or new beginning?', in Dovers (ed), *Environmental history and policy*, pp. 24-46.

¹³³ J. S. Benson and P. A. Redpath, 'The nature of pre-European native vegetation in south-eastern Australia: a critique of Ryan *et al.* (1995) 'The Australian landscape – observations of explorers and early settlers'', *Cunninghamia*, Vol. 5, 1997, pp. 285-328; Rolls, *A million wild acres*; Flannery, *Future eaters*; D. G. Ryan *et al.*, *The Australian landscape: observations of explorers and early settlers*, Murrumbidgee Catchment Management Committee, Wagga Wagga, New South Wales, 1995; D. Best, 'Australia's greentime history', *History Today*, Vol. 47, No. 10, 1997, pp. 9-11.

¹³⁴ T. Griffiths and L. Robin (eds), *Ecology and Empire: environmental history of settler societies*, University of Washington Press, Seattle, 1997; T. Griffiths, 'Ecology and Empire: towards an Australian history of the world', in Griffiths and Robin (eds), *Ecology and Empire*, pp. 1-16, p. 1.

In contrast to these studies based on qualitative sources, a scientific study of Australian environmental history was produced by Archer *et al.*¹³⁵ Unlike other historical accounts, that work is a scientific environmental history which spans the much longer period of 100 million years, including the pre-human environment. Archer *et al.* acknowledged that human impacts in Australia have changed through time, but that those impacts were particularly influential at the times when new ecosystems were colonised. In particular, radical environmental transformations took place as a result of European settlement, including the introduction of exotic species, the establishment of agriculture and mining, the disruption of Indigenous patch burning practices, the exploitation of whale and seal populations and the pollution of coastal water supplies. Archer *et al.* stated that:

resource exploitation of the Australian landscape following European arrival has led to massive environmental degradation. This degradation has been amplified by the impacts of exotic herd animals, land clearance for cultivation of introduced plant species, other biological introductions and the use or inadvertent production of environmentally toxic materials.¹³⁶

Widespread European impacts in Australia were exacerbated more recently by rapid population growth, they claimed, and the period since European settlement has been characterised by unprecedented rates of environmental change.

Another scientific account of environmental changes in Australia since European settlement was written by Young, who considered the histories of Australian aridity, forest clearance and soil erosion, arguing that those changes occurred as a result of the interaction of natural and anthropogenic forces.¹³⁷ Young described the impacts of agriculture, forestry, mining, urbanisation and conservation on the Australian environment; she also considered the alteration of marine and coastal environments as a result of fishing, oil and ballast-water pollution, nutrient runoff and sand mining. Young's environmental history is a valuable overview of the main changes in the Australian environment since European settlement; but, like other surveys of Australian environmental history at the continental scale, it represents a general account. Continental-scale studies are inevitably selective in their coverage and do not consider

¹³⁵ M. Archer *et al.*, *From plesiosaurs to people: 100 million years of Australian environmental history*, Australia: State of the Environment Technical Paper Series (Portrait of Australia), Department of the Environment, Canberra, 1998.

¹³⁶ Archer *et al.*, *From plesiosaurs to people*, p. 60.

¹³⁷ Young, *Environmental change in Australia*.

the complexity of environmental changes in particular places; as Pawson and Dovers have acknowledged, some of the best environmental histories have described small places.¹³⁸

Other continental-scale environmental histories were published in a second collection by Dovers, which adopted a utilitarian approach to Australian environmental history and suggested ways in which the sub-discipline could inform environmental policy; that collection contained an overview of Australian environmental history, by Rolls, and explored many other themes, including the relationships between environment, history and policy. Nevertheless, Dovers' collection did not contain a study of the extensively managed marine environment of the GBRWHA.¹³⁹ The surveys of environmental history at the continental scale that have been reviewed above are necessarily partial and selective; however, many other Australian environmental histories focused on smaller, state-wide and regional scales or have considered particular topics (Table 2.7). I review a selection of state-wide and regional surveys below.

2.4.2 Australian environmental histories at state-wide and regional scales

State-wide and regional studies of Australian environmental history include some of the seminal studies of the sub-discipline.¹⁴⁰ While there are relatively few state-wide environmental histories, surveys at the regional scale are more common (Table 2.7), probably reflecting the fact that many Australian ecosystems are smaller than some states of Australia, and that many ecosystems cross state boundaries. However, both state-wide and regional studies of Australian environmental history are, in general, more detailed than continental-scale surveys. As a result, some continental-scale collections of environmental history – such as those, mentioned above, by Rapoport, Smith and Dovers – also included studies at smaller spatial scales. An early state-wide survey was the seminal study of the historical geography of the South Australian landscape by Williams, which described numerous impacts of European settlement in that state since

¹³⁸ Pawson and Dovers, 'Environmental history', p. 65.

¹³⁹ Dovers, *Environmental history and policy*; Rolls, 'The end, or new beginning?'; Dovers, 'Still settling Australia'.

¹⁴⁰ For examples, see D. W. Meinig, *On the margins of the good earth: the South Australian wheat frontier, 1869-1884*, Rigby, Adelaide, 1962; W. K. Hancock, *Discovering Monaro: a study of man's impact on his landscape*, Cambridge University Press, Cambridge, 1972; M. Williams, *The making of the South Australian landscape: a study in the historical geography of Australia*, Academic Press, London, 1974.

1836 and considered both the exploitation and conservation of land.¹⁴¹ That study was influenced by the important regional analysis of the South Australian landscape by Meinig and it argued for the inclusion of an ecological element within history: a position that anticipated Worster's agroecological approach (Section 2.2.3).¹⁴²

In addition to the consideration given to the environment in Australian historical geography, the subject received attention by several Australian historians. Bolton had produced a continental-scale account, mentioned in Section 2.4.1; several state-wide histories also described environmental changes, including two histories of Queensland, by Fitzgerald, which described the periods before and after 1915 respectively.¹⁴³ Those works considered Indigenous land management, the Europeans settlement of the Queensland coast, early industrial development, impacts of sugar cane farming, and oil exploration and tourism in the Great Barrier Reef. Fitzgerald's accounts were followed by a history of the South Australian environment, by Whitelock, and by a collection of studies, edited by Nance and Speight, that considered transformations of the South Australian landscape.¹⁴⁴ Another history of Queensland, by Johnston, also included some environment impacts; his account was based on documentary sources and described some activities related to the Great Barrier Reef: bêche-de-mer fishing, the settlement at Palm Island, and sugar cane farming on the adjacent Queensland coast.¹⁴⁵ These works, in addition to Bolton's study, represent the main works of Australian history that have considered environmental changes.

State-wide studies form a small part of the literature of Australian environmental history and their spatial coverage is selective; in contrast, many regional Australian environmental histories exist (Table 2.7). These works include an influential study by Meinig that investigated the South Australian wheat frontier between 1869 and 1884. In that account, Meinig reconstructed the pre-colonial condition of the land before describing the impacts of European settlement and agriculture.¹⁴⁶ Meinig's study was

¹⁴¹ Williams, *Making of the South Australian landscape*.

¹⁴² Meinig, *On the margins*; Worster, 'History as natural history'.

¹⁴³ Bolton, *Spoils and spoilers*; Fitzgerald, *From the Dreaming to 1915*; R. Fitzgerald, *From 1915 to the early 1980s: a history of Queensland*, UQ Press, St. Lucia, Queensland, 1984.

¹⁴⁴ D. Whitelock, *Conquest to conservation: history of human impact on the South Australian environment*, Wakefield Press, Cowandilla, South Australia, 1985; C. Nance and D. L. Speight (eds), *A land transformed: environmental change in South Australia*, Longman Cheshire, Melbourne, 1986.

¹⁴⁵ W. R. Johnston, *A documentary history of Queensland*, UQ Press, St. Lucia, Queensland, 1988.

¹⁴⁶ Meinig, *On the margins of the good earth*.

followed by another significant, regional work that described environmental change: the account of European impacts in northern Australia by Bauer, which included an account of the pearl-shelling industry; that work informs the account of pearl-shelling in the Great Barrier Reef that is presented in Section 5.3.2.¹⁴⁷ Other important works followed Bauer's study: an account of the environmental transformations in a border region of New South Wales and Queensland by Heathcote; a history of the Riverina, in New South Wales and Victoria, by Buxton; and a study of the Monaro region, in southern New South Wales, by Hancock.¹⁴⁸ Those studies were innovative as they provided comparative analyses of environmental changes near, or across, political borders.

Numerous other regional surveys of environmental history have been written, including both scientific and historical studies; those works are not reviewed here but an overview of their geographical coverage indicates a predominant concern with environments in the south and east of Australia: for example, northern New South Wales, the Snowy Mountains, Mount Kosciusko, the Hawkesbury-Nepean Catchment and the Northern Adelaide Plains.¹⁴⁹ Even in the recent, continental-scale collection of Australian environmental histories by Dovers, many of the studies investigated south-eastern environments: the Monaro, Kiola, the southern tablelands and the Bogong High Plains, all of which are located in New South Wales.¹⁵⁰ While there are exceptions – including the studies of the Great Barrier Reef by Bowen, and by Bowen and Bowen – an emphasis on southern and eastern locations characterised most regional Australian

¹⁴⁷ F. H. Bauer, *Historical geography of white settlement in part of northern Australia: Part 2: The Katherine-Darwin region*, CSIRO Division of Land Research and Regional Survey, Divisional Report No. 64/1, April 1964, CSIRO, Canberra, 1964.

¹⁴⁸ R. L. Heathcote, *The Back of Bourke: a study of land appraisal and settlement in semi-arid Australia*, Melbourne University Press, Melbourne, 1965; G. L. Buxton, *The Riverina, 1861-1891: an Australian regional study*, Melbourne University Press, Carlton, Victoria, 1967; Hancock, *Discovering Monaro*.

¹⁴⁹ E. Jamieson *et al.*, 'The spatial scale of European colonization and land alienation in northern New South Wales, 1850-1910', *Australian Geographer*, Vol. 15, 1983, pp. 322-324; S. D. Mooney *et al.*, 'Late Holocene environmental change in an upper montane area of the Snowy Mountains, New South Wales', *Australian Geographer*, Vol. 28, No. 2, 1997, pp. 185-200; J. R. Dodson *et al.*, 'A thousand years of environmental change and human impact in the alpine zone at Mt. Kosciusko, New South Wales', *Australian Geographer*, Vol. 25, No. 1, 1994, pp. 77-87; S. Rosen, *Losing ground: an environmental history of the Hawkesbury-Nepean Catchment*, Hale and Iremonger, Sydney, 1995; D. L. Smith, 'The pre-settlement hydrology and vegetation of the Northern Adelaide Plains and the progress of settlement and clearing during the nineteenth century', *Australian Geographer*, Vol. 19, No. 2, 1988, pp. 242-258.

¹⁵⁰ S. Dovers, 'Still discovering Monaro: perceptions of landscape', in Dovers (ed), *Australian environmental history*, pp. 119-140; K. Fry, 'Kiola: a history of the environmental impact of European occupation, 1830-1980', in Dovers (ed), *Australian environmental history*, pp. 99-118; K. Johnson, 'Creating place and landscape', in Dovers (ed), *Australian environmental history*, pp. 37-54; R. Lawrence, 'Environmental changes on the Bogong High Plains, 1850s to 1980s', in Dovers (ed), *Australian environmental history*, pp. 167-197.

environmental histories; other parts of Australia – including marine and coastal areas – have been comparatively neglected.¹⁵¹ In addition to the works mentioned above, however, many other regional environmental histories exist, although some are more appropriately classified by topic. A selection of topical works is reviewed briefly below.

2.4.3 Australian environmental histories focusing on particular topics

Many Australian environmental histories focus on a single topic. A selection of these topical works is shown in Table 2.7; many are vegetation histories, including many forest histories which are shown separately. Some early vegetation histories include a reconstruction of pre-European vegetation, by Jeans, and an account of changes in Australian vegetation since European settlement, by Adamson and Fox; the latter work is found in a collection of other vegetation histories, edited by Smith.¹⁵² Some authors have outlined general changes in Australian vegetation, as White has done; others describe smaller-scale vegetation changes, such as Colhoun's reconstruction of a vegetation history at Poets Hill Lake, in Western Tasmania.¹⁵³ Vegetation histories of locations in south-eastern Australia abound, including examples by Benson and Redpath, Lunt, and McGrath and Boyd.¹⁵⁴ All of those studies indicate that extensive changes have taken place in Australian vegetation as a result of human activity, although the details of those changes are not described here.

Forest histories form a large subset of Australian vegetation histories, indicating the economic importance of Australian forests and the magnitude of the barrier they presented to European settlers. Frawley wrote a forest history for north-east Queensland and acknowledged the large extent of forest clearance that accompanied closer settlement in that region. Related studies included the Atherton Tableland rainforest

¹⁵¹ Bowen, 'Great Barrier Reef'; Bowen and Bowen, *Great Barrier Reef*.

¹⁵² D. N. Jeans, 'Mapping natural vegetation from documentary sources in New South Wales', *Australian Geographer*, Vol. 14, 1978, pp. 93-97; D. A. Adamson and M. D. Fox, 'Changes in Australasian vegetation since European settlement', in J. M. B. Smith (ed), *A history of Australasian vegetation*, McGraw-Hill, Sydney, 1982, pp. 109-149.

¹⁵³ Cf. M. White, 'Evolution of an Australian flora', in Smith (ed), *The unique continent*, pp. 59-69; E. A. Colhoun, 'Late glacial and Holocene vegetation history at Poets Hill Lake, western Tasmania', *Australian Geographer*, Vol. 23, No. 1, 1992, pp. 11-23.

¹⁵⁴ Benson and Redpath, 'Nature of pre-European native vegetation'; I. D. Lunt, 'The distribution and environmental relationships of native grasslands on the Lowland Gippsland Plain, Victoria: an historical study', *Australian Geographical Studies*, Vol. 35, No. 2, 1997, pp. 140-152; R. McGrath and W. E. Boyd, 'Holocene vegetation history of Bundjalung National Park and Bungawalbin Creek, north-eastern New South Wales', *Australian Geographer*, Vol. 29, No. 2, 1998, pp. 205-222.

history, by Birtles, and an account of the forest history of the continental islands of Queensland, by Brennan.¹⁵⁵ At the national scale, Dargavel provided many forest histories indicating the extent of European exploitation of Australian forests and the creation of forest plantations; the former theme was also discussed by Stubbs in his history of ringbarking. Griffiths has also provided important studies of forest history, describing the clearance of forests for agriculture and, more recently, an environmental history of Mountain Ash forests, based on documentary records.¹⁵⁶

Griffiths' work exemplifies the use made of qualitative sources, increasingly, by Australian environmental historians. For example, studies of the north Queensland rainforest using documentary and oral sources have been produced by Hill, and by Hill *et al.*, which describe changes in the Wet Tropics of Queensland in response to the use of fire by Indigenous people and in relation to closer settlement in north Queensland and the spread of sugar cane farming.¹⁵⁷ Using a similar, qualitative approach – but focusing exclusively on the collection of oral histories – Borschmann published *The people's forest* study, which describes changes in Australian forests from the perspectives of many individual informants.¹⁵⁸ Those studies indicate the diversity of approaches found even within a subset of Australian environmental history. Yet while the works listed here represent only a fraction of the literature of Australian forest histories, they indicate

¹⁵⁵ K. J. Frawley, 'The 'inexhaustible scrub' and the closer settlement ideal: the northern rainforests in Queensland development', in P. Griggs (ed), *Shaping Queensland through history: a collection of papers presented at a Queensland day symposium, 6 June 1988, hosted by the Royal Geographical Society of Australasia (Queensland) Inc. and the Royal Historical Society of Queensland*, Royal Geographical Society of Australasia (Queensland) Inc., Brisbane, 1988, pp. 21-41; T. G. Birtles, 'European interpretation of the Atherton-Evelyn 'vine scrub' of tropical north Queensland, 1880-1920', in J. Dargavel *et al.* (eds), *Changing tropical forests: historical perspectives on today's challenges in Asia, Australasia and Oceania*, Workshop meeting, Canberra, 16-18 May 1988, CRES, Canberra, 1988, pp. 197-216; P. F. Brennan, 'Forest history of the continental islands: Great Barrier Reef', in Dargavel *et al.* (eds), *Changing tropical forests*, pp. 327-337.

¹⁵⁶ J. Dargavel, 'Constructing Australia's forests in the image of capital', in Dovers (ed), *Australian environmental history*, pp. 80-98; J. Dargavel, *Fashioning Australia's forests*, Oxford University Press, Melbourne, 1995; J. Dargavel *et al.* (eds), *Perfumed pineries: environmental history of Australia's Callitris forests*, CRES, Canberra, 2001; B. J. Stubbs, 'Land improvement or institutionalised destruction? The ringbarking controversy, 1879-1884, and the emergence of a conservation ethic in New South Wales', *Environment and History*, Vol. 4, No. 2, 1998, pp. 145-167; T. Griffiths, 'Secrets of the forest: writing environmental history', in Garden (ed), *Created landscapes*, pp. 42-51; T. Griffiths, *Forests of Ash: an environmental history*, Cambridge University Press, Cambridge, 2002.

¹⁵⁷ R. Hill *et al.*, 'Aborigines and fire in the Wet Tropics of Queensland, Australia: ecosystem management across cultures', *Society and Natural Resources*, Vol. 12, 1999, pp. 205-223; R. Hill *et al.*, 'Rainforests, agriculture and Aboriginal fire-regimes in Wet Tropical Queensland, Australia', *Australian Geographical Studies*, Vol. 38, No. 2, 2000, pp. 138-157.

¹⁵⁸ G. Borschmann (ed), *The people's forest: a living history of the Australian bush*, The People's Forest Press, Blackheath, New South Wales, 1999.

the importance of this topic within Australian environmental history. Forest and vegetation histories, therefore, comprise a major, diverse subset of Australian environmental histories.

Water histories comprise another large subset of Australian environmental history studies, reflecting the historical importance of water management in Australia (Table 2.7). An early water history for the southern tablelands of New South Wales was written by Eyles, and a subsequent study of human impacts on Australian drainage systems was produced by Warner. Gell and Stuart considered the environmental history of the Delegate River Catchment, in eastern Victoria, acknowledging the degradation of watercourses that resulted from the actions of European settlers; another account that focused on the degradation of a river was the influential study of the Snowy River, by Seddon, which described the impacts of introduced species, mining, and the Snowy River Hydroelectric Scheme.¹⁵⁹ Many historical studies of Australian water management have been produced by Powell; nonetheless, Powell argued that the topic of Australian water management deserves more prominence within the sub-discipline of environmental history.¹⁶⁰

As with forest and vegetation histories, a subset of water histories has used qualitative methods to reconstruct past environments. Finlayson and Brizga used oral history to investigate river basin management; Rosen explored the environmental history of the Hawkesbury-Nepean catchment, to the west of Sydney, using documentary sources; Roberts and Sainty considered the use of oral history material in river management in the Murray-Darling Basin; and the use of historical sources in catchment management in the southern tablelands of New South Wales has been explored by Wasson and Sidorchuk. Despite the abundance and variety of water histories in the literature of

¹⁵⁹ R. J. Eyles, 'Changes in drainage networks since 1820, southern tablelands, N.S.W.', *Australian Geographer*, Vol. 13, No. 6, 1977, pp. 377-386; R. F. Warner, 'Man's impacts on Australian drainage systems', *Australian Geographer*, Vol. 16, No. 2, 1984, pp. 133-140; P. A. Gell and I. M. Stuart, *Human settlement history and environmental impact: the Delegate River Catchment, East Gippsland, Victoria*, Monash Publications in Geography No. 36, Dept. of Geography and Environmental Science, Monash University, Melbourne 1989; Seddon, *Searching for the Snowy*.

¹⁶⁰ J. M. Powell, *Watering the garden state: water, land and community in Victoria, 1834-1988*, Allen and Unwin, Sydney, 1989; J. M. Powell, *Plains of promise, rivers of destiny: water management and the development of Queensland, 1824-1990* Boolarong Publications, Brisbane, 1991; J. M. Powell, 'Snakes and cannons: water management and the geographical imagination in Australia', in Dovers (ed), *Environmental history and policy*, pp. 47-71.

Australian environmental history, however, none include any consideration of coastal or marine environments.¹⁶¹

Soil histories form another group of Australian environmental histories (Table 2.7). Accounts of soil erosion are found early in the literature since one work, by Holmes, described the occurrence of soil erosion in Australia and New Zealand; many more recent works have investigated the themes of soil erosion and land degradation. Some, such as the studies by Dovers, and by Rolls, described cumulative impacts on Australian soils, particularly as a result of the ignorance of early settlers about the distinctive nature of the Australian environment.¹⁶² In general, the authors of these accounts of land degradation have identified connections between European forest clearance, closer settlement of land, droughts and soil erosion; Frost, for example, acknowledged the interconnections between European farming, pests, agriculture and forest clearance in eastern Australia.¹⁶³ Again, analysis of these examples indicates a general concern with environments in southern and eastern Australia, although Western Australia has also received some attention; in contrast, no environmental history of the loss of soil from the GBRCA has yet been written.

Histories of fire form another subset of Australian environmental histories (Table 2.7). In several studies, Pyne has argued that fire allowed Aboriginal Australians to manage most of the landscape; Rolls, likewise, regarded fire as a critical factor in the creation of the modern Australian landscape. However, a different approach was adopted by Hill *et al.*, who argued that traditional management of the WTWHA by the Kuku-Yalanji

¹⁶¹ B. L. Finlayson and S. O. Brizga, 'The oral tradition, environmental change and river basin management: case studies from Queensland and Victoria', *Australian Geographical Studies*, Vol. 33, No. 2, 1995, pp. 180-192; Rosen, *Losing ground*; J. Roberts and G. Sainty, 'Oral history, ecological knowledge, and river management', in Dovers (ed), *Environmental history and policy*, pp. 118-144; R. Wasson and A. Sidorchuk, 'History for soil conservation and catchment management', in Dovers (ed), *Environmental history and policy*, pp. 97-117.

¹⁶² Examples include J. M. Holmes, *Soil erosion in Australia and New Zealand*, Angus and Robertson, Sydney, 1946; R. Beale and P. Fray, *The vanishing continent: Australia's degraded environment*, Hodder and Stoughton, Sydney, 1990; S. Boucher and J. M. Powell, 'Gullyling and tunnel erosion in Victoria', *Australian Geographical Studies*, Vol. 31, No. 1, 1994, pp. 17-26; A. G. Brunger and J. Selwood, 'Settlement and land alienation in Western Australia: the Shire of Denmark', *Journal of Historical Geography*, Vol. 23, No. 4, 1997, pp. 478-495; E. Nathan, 'Dryland salinity on the Dundas Tableland: a historical appraisal', *Australian Geographer*, Vol. 30, No. 3, 1999, pp. 295-310; M. Letnic, 'Dispossession, degradation and extinction: environmental history in arid Australia', *Biodiversity and Conservation*, Vol. 9, No. 3, 2000, pp. 295-308.

¹⁶³ W. Frost, 'European farming, Australian pests: agricultural settlement and environmental disruption in Australia, 1800-1920', *Environment and History*, Vol. 4, No. 2, 1998, pp. 129-143.

group, using fire, has been impeded by the recent environmental management of the WTWHA. In another account, Hill *et al.* reconstructed a vegetation history of the Mossman area using aerial photographs, surveyors' maps, lands selectors' files, Aboriginal Protectors' and Colonial Secretary's files, parliamentary papers, travel writing, newspaper articles, historical photographs and oral histories. Those authors challenged the view that Aboriginal fire regimes in the coastal wet tropics of Queensland caused significant rainforest decline in the past.¹⁶⁴ These last two studies have challenged previous views of the nature and use of fire in the Australian landscape. Therefore, Australian fire histories support Cronon's argument about the ways in which different narrators can tell different stories about environmental changes.¹⁶⁵

Another Australian fire history was written by Crowley and Garnett, who investigated changing patterns of fire management in the pastoral lands of Cape York Peninsula between 1623 and 1996.¹⁶⁶ They contrasted European accounts of burning by Aboriginal Australians during this period with documentary records kept by pastoralists, finding significant differences in these records, and suggesting that an alternative narrative of Aboriginal fire impacts could be written. This study, together with those by Hill *et al.*, offered more specific, complex understandings of fire history than the general fire histories by Pyne and Rolls. Another detailed analysis of qualitative fire records was produced by Vigilante, who used the journals of explorers and colonists to reconstruct the history of landscape burning in the Kimberley region of Western Australia since European settlement.¹⁶⁷ This work also evaluated the use of documentary and oral sources in reconstructing environmental history, and suggested that the collection of qualitative interviews with Traditional Owners in the Kimberley region could yield valuable data; the debate about the extent of the impacts of Indigenous firing practices has not yet been settled.

¹⁶⁴ S. J. Pyne, 'Firestick history', *Journal of American History*, Vol. 76, No. 4, 1990, pp. 1132-1141; S. J. Pyne, *Burning bush: a fire history of Australia*, Allen and Unwin, Sydney, 1991; S. J. Pyne, *Vestal fire: an environmental history, told through fire, of Europe and Europe's encounter with the world*, University of Washington Press, Seattle, 1997; Rolls, 'Nature of Australia'; Hill *et al.*, 'Aborigines and fire'; Hill *et al.*, 'Rainforests, agriculture and Aboriginal fire regimes'.

¹⁶⁵ Cronon, 'A place for stories'.

¹⁶⁶ G. M. Crowley and S. T. Garnett, 'Changing fire management in the pastoral lands of Cape York Peninsula of northeastern Australia, 1623 to 1996', *Australian Geographical Studies*, Vol. 38, No. 1, 2000, pp. 10-26.

¹⁶⁷ T. Vigilante, 'Analysis of explorers' records of Aboriginal landscape burning in the Kimberley region of Western Australia', *Australian Geographical Studies*, Vol. 39, No. 2, 2001, pp. 135-155.

Similar tensions are found in the literature of Australian faunal histories. An early account of changes in the Australian landscape caused by rabbits, foxes, dingoes and wombats was provided by Matthams; Rolls has also described the impacts of faunal change in Australia, especially the effects of rabbits.¹⁶⁸ More recently, Jarman described the impacts of the spread of red fox populations, and Morton investigated the impacts of European settlement on Australian arid-dwelling mammals, including the extinction of some medium-sized mammals.¹⁶⁹ Several authors, including Flannery, Benson and Redpath, and Choquenot and Bowman, have discussed the hypothesis that the extinction of Australian megafauna resulted from Indigenous hunting practices. A distinctive perspective was articulated by Bowman and Robinson, who explored the changing relationships between Indigenous people and mega-herbivores through time, and by Suchet, who examined changing concepts of wildlife management and acknowledged the persistence of colonial, Eurocentric ideas about Australian faunal management.¹⁷⁰ These studies, shown in Table 2.7, reflect diverse opinions about the relative impacts of Europeans settlers and Indigenous Australians on Australian fauna.

Other topics, such as urban, climate, coastal and marine histories, are less prominent in the literature of Australian environmental history (Table 2.7). Australian climate histories are also comparatively scarce, although Puotinen *et al.*, Nott and Hayne, and Nott have reconstructed historical occurrences of cyclones.¹⁷¹ Few environmental histories exist for coastal or marine areas, although many scientific accounts of changes in coastal morphology have been written. The latter are not considered here because,

¹⁶⁸ J. Matthams, *The rabbit pest in Australia: with chapters on foxes, dingoes, wombats, The Fences Act of Victoria and noxious weeds*, Speciality Press, Melbourne, 1921; Rolls, *They all ran wild*.

¹⁶⁹ P. Jarman, ‘Spread of the red fox’, in Smith (ed), *The unique continent*, pp. 187-191; S. Morton, ‘European settlement and the mammals of arid Australia’, in Dovers (ed), *Australian environmental history*, pp. 141-166.

¹⁷⁰ Flannery, *Future eaters*; Benson and Redpath, ‘Nature of pre-European native vegetation’; D. Choquenot and D. M. J. S. Bowman, ‘Marsupial megafauna, Aborigines and the overkill hypothesis: application of predator-prey models to the question of Pleistocene extinction in Australia’, *Global Ecology and Biogeography Letters*, Vol. 7, 1998, pp. 167-80; D. M. J. S. Bowman and C. J. Robinson, ‘The getting of the Nganabbarru: observations and reflections on Aboriginal buffalo hunting in northern Australia’, *Australian Geographer*, Vol. 33, No. 2, 2002, pp. 191-206; S. Suchet, ‘Totally wild? Colonising discourses, Indigenous knowledges and managing wildlife’, *Australian Geographer*, Vol. 33, No. 2, 2002, pp. 141-157.

¹⁷¹ M. L. Puotinen *et al.*, *An atlas of tropical cyclones in the Great Barrier Reef region: 1969-1997*, CRC Reef Research Centre, Technical Report No. 19, CRC Reef Research Centre, Townsville, 1997; J. F. Nott and M. Hayne, ‘How high was the storm surge from Tropical Cyclone Mahina, north Queensland, 1899?’, *Australian Journal of Emergency Management*, Autumn 2000, pp. 11-13; J. F. Nott and M. Hayne, ‘High frequency of “super-cyclones” along the Great Barrier Reef over the past 5,000 years’, *Nature*, Vol. 413, 4 October 2001, pp. 508-511; J. F. Nott, ‘Intensity of prehistoric tropical cyclones’, *Journal of Geophysical Research*, Vol. 108, No. D7, 4212, 2003, pp. 1-11.

while those accounts describe environmental changes, they cannot be defined strictly as environmental histories as they do not focus specifically on the changing relationships between coastal environments and humans.

Most histories of coastal and marine environments are resource histories. For example, the development of the Australian pearl industry was described by Bauer and George; Ganter produced a history of pearl-shelling in Torres Strait that described the depletion of those pearl oyster beds. Several histories of Australian whaling have been written that acknowledge the severe depletion of humpback whales as a result of that industry. Fishing histories include studies of the Swan-Canning fishery, in Western Australia, and of the Queensland commercial fishing industry.¹⁷² Other coastal resource histories include a study of the exploitation of intertidal vegetation in eastern Australia for soap manufacture during the nineteenth-century, by Bird; an account of the sand mining industry in eastern Australia, by Morley; and Brown's history of the southern coast of New South Wales.¹⁷³ All of those works may be regarded as types of environmental histories since their narratives of environmental changes are linked to stories of European settlement or coastal development in Australian coastal regions, although none of those studies were produced by environmental historians. Nonetheless, these works indicate that European settlement in Australia was accompanied by considerable exploitation of coastal and marine resources.

Within the literature of Australian environmental histories, a small subset of studies used oral histories to reconstruct environmental changes, and some of these works have been mentioned above (Table 2.7). Sanders has used oral histories to document changes

¹⁷² Bauer, 'Historical geography'; C. D. George, *Development of pearl cultivation in Australia: Part 1, historical aspects on the early discovery of the pearl cultivating technique*, Occasional Paper Series No. 10, Cairns Historical Society, Cairns, 1987; R. Ganter, *The pearl-shellers of Torres Strait: resource use, development and decline, 1860s-1960s*, Melbourne University Press, Carlton, Victoria, 1994; D. Jones, *The whalers of Tangalooma*, The Nautical Association of Australia Inc., Melbourne, 1980; D. Jones, 'The whalers of Tangalooma 1952-1962', in M. Johnson (ed), *Brisbane: Moreton Bay matters*, Brisbane History Group Papers No. 19, Brisbane History Group, Brisbane, 2002, pp. 87-94; P. R. Weaver, *An ethnohistorical study of the Swan-Canning fishery in Western Australia, 1697-1837*, BA (Hons) Thesis, Edith Cowan University, Perth, 1991; N. Haysom, *Trawlers, trollers and trepangers: the story of the Queensland commercial fishing industry pre-1988*, QDPI, Brisbane, 2001.

¹⁷³ J. F. Bird, 'The nineteenth-century soap industry and its exploitation of intertidal vegetation in eastern Australia', *Australian Geographer*, Vol. 14, No. 1, 1978, pp. 38-41; I. W. Morley, *Black sands: a history of the mineral sand mining industry in eastern Australia*, UQ Press, St. Lucia, Queensland, 1982; N. Brown, 'On the margins of the Littoral Society: the New South Wales South coast since 1945', *Environment and History*, Vol. 4, No. 2, 1998, pp. 209-237.

in Western Australian wetlands, and oral histories of the Wanneroo wetlands – also in Western Australia – were collected by Kennealy. Finlayson and Brizga compared oral history with documentary records to reconstruct an environmental history of the Nogoa River in Queensland and the Avon River in Victoria; Brunger and Selwood also used oral histories in their history of European settlement in Western Australia. Roberts and Sainty evaluated the potential of oral histories in environmental history research into ecological knowledge and river management.¹⁷⁴ All of the authors of these studies acknowledged the unique nature of oral history data and argued that oral histories represent a distinctive source of information. However, Finlayson and Brizga argued that oral and documentary sources produce different accounts of environmental changes; for the Snowy River, documentary records indicated multiple causes of environmental changes, while oral evidence was unequivocal. Consequently, most of these studies used triangulation of sources as a strategy to reduce biases in oral sources.

Although many of the Australian environmental histories reviewed in this section have been categorised by topic, some studies consider several topics; the categories shown in Table 2.7 are broad generalisations. In particular, histories of soil, fire and vegetation are interrelated in the literature because the clearance of forests using fire, the development of agriculture, and soil erosion often coincided geographically. Also, the studies differ according to geographical scale. While studies of soil have generally focused on the regional scale, for example, fire histories have considered both regional and continental scales. However, many Australian environmental histories share a common concern with rural environments: this is one of several similarities between these studies. Such a rural emphasis is explicable in the context of the European settlement of Australia, which depended upon forest clearance, mineral resources, agriculture and pastoralism, and in which the management of water was critically important. However, in contrast to rural environments, coastal and marine environments have been relatively neglected within the literature.

¹⁷⁴ A. Sanders, *Oral histories documenting changes in wheatbelt wetlands*, Western Australia Department of Conservation and Land Management, Como, 1991; S. Kennealy, *Oral histories of the Wanneroo wetlands: recollections of Wanneroo pioneers, changes that occurred between European settlement and the 1950s*, Western Australia, Water Authority of Western Australia, Perth, 1994; Finlayson and Brizga, ‘Oral tradition’; Brunger and Selwood, ‘Settlement and land alienation’; Roberts and Sainty, ‘Oral history’.

A second similarity between many of the Australian environmental histories reviewed above is a predominant focus on environments in the south and east of the country. In particular, there have been many environmental histories of the states and regions of South Australia, Victoria and New South Wales; that bias is shown in Figure 2.6, which illustrates the distribution of locations studied in those accounts that relate to regional or sub-regional environments. Although many of the studies shown in Figure 2.6 occupy locations close to the Australian coast, most have not been directly concerned with coastal habitats. The distribution of studies shown in Figure 2.6 also suggests that, apart from the studies by Bauer, Brunger and Selwood, and Powell, little attention has been paid to the environmental history of northern and western parts of Australia.¹⁷⁵ Most of the studies that have described Queensland environments are vegetation and fire histories, and marine and coastal environments have been comparatively neglected.

A third similarity between many of these environmental histories – despite wide variation in the methods used by their authors – is a focus on the degradation of the environment since European settlement. The theme of environmental degradation was prominent in the collection of Australian environmental history studies published in *Environment and History* in 1998, which also reflected the south-eastern, terrestrial focus of the sub-discipline and its preoccupation with forests.¹⁷⁶ Documentary sources, including the records of early European explorers and settlers, form the basis of many such accounts of land degradation; in one study, for example, Lunt argued that documentary sources are invaluable in reconstructing Australian vegetation histories, but he acknowledged some important omissions in those records and suggested that they are indicative, but not exact.¹⁷⁷

One outcome of this emphasis on environmental degradation in works of Australian environmental history is that many studies conclude that the Australian environment has been degraded since European settlement. Powell summarised that view, stating:

¹⁷⁵ Bauer, ‘Historical geography’; Brunger and Selwood, ‘Settlement and land alienation’; Powell, *Watering the western third*.

¹⁷⁶ Frost, ‘European farming’; Stubbs, ‘Land improvement’; J. Dargavel, ‘The Coming of age to Australian forests’, *Environment and History*, Vol. 4, No. 2, 1998, pp. 169-190; L. Robin, ‘Radical ecology and conservation science: an Australian perspective’, *Environment and History*, Vol. 4, No. 2, 1998, pp. 191-208; Brown, ‘On the margins of the Littoral Society’.

¹⁷⁷ Lunt, ‘Distribution and environmental relationships’; Lunt, ‘Tree densities’.

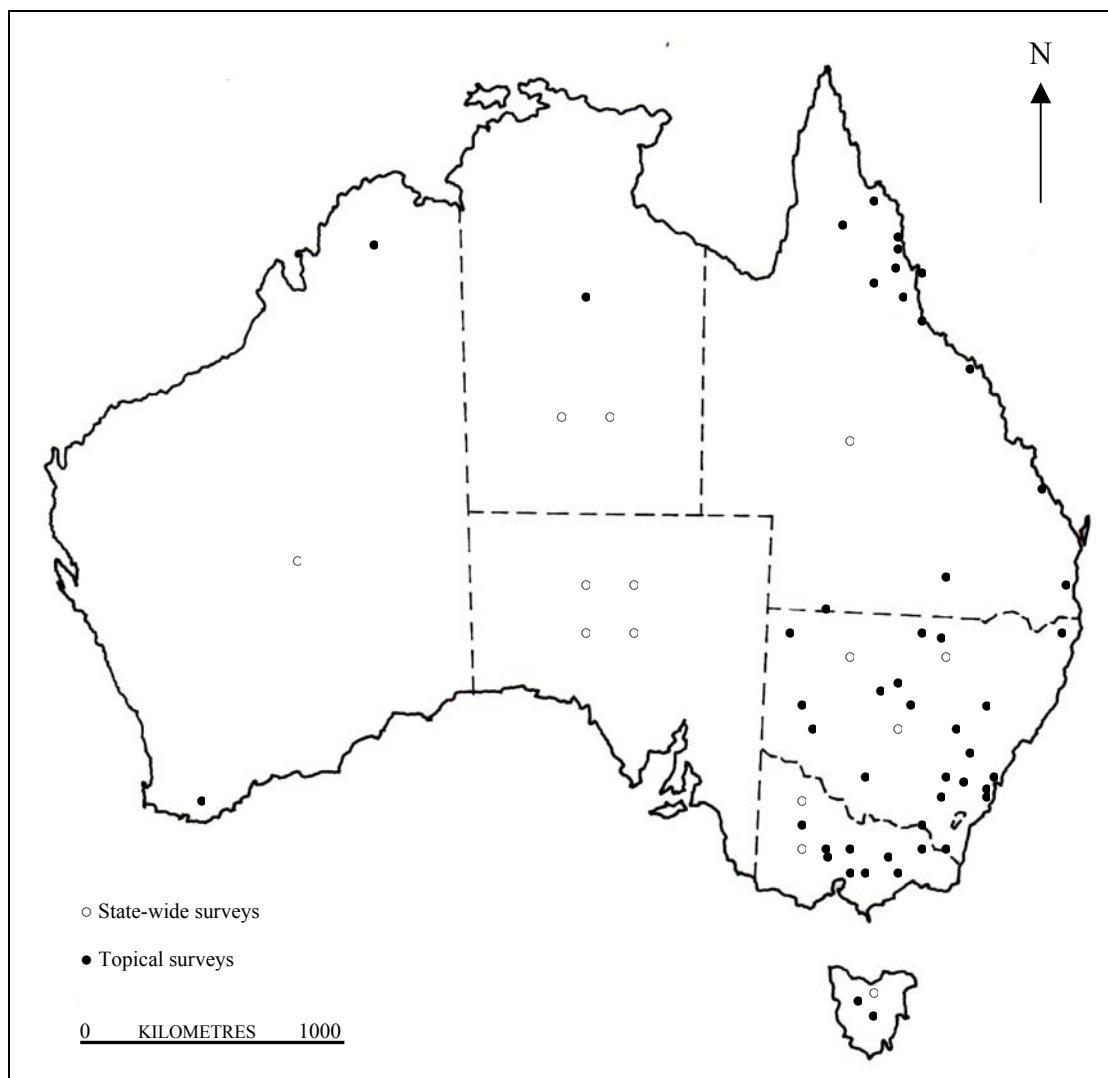


Figure 2.6. Locations of environments considered in a selection of Australian environmental histories.

Australia's environments have been dramatically transformed by immigrant communities [...]. With the exception of a few critical junctures and significant but highly localised settings which are reasonably well supplied with primary material, the historical records are scarcely satisfactory for fine-textured reconstructions of changing physical landscapes.¹⁷⁸

As a result of that paucity of historical records, and despite the numerous studies of environmental history that have been produced, the reconstruction of past Australian environments remains problematic. Consequently, Dovers advocated a mosaic of smaller scale environmental histories and Powell called for co-operative research that combines physical and documentary evidence for specific Australian environments.¹⁷⁹

My review of the literature of Australian environmental history suggests that studies are required for some comparatively neglected, yet significant, Australian environments, including some coastal and marine environments; such an attempt is timely because, as Russell argued, their heritage value is contested. He stated that Australians face:

the simultaneous tasks of constructing cultural identity in a land they have much to learn about, and developing an appropriate environmental ethic in times marked by humanity's capacity to alter ecosystems rapidly.¹⁸⁰

Many areas for further research within the sub-discipline of environmental history were listed by Powell, although coastal and marine environments are absent even from that list.¹⁸¹ My review of the literature also indicates that few environmental histories exist for Queensland environments, other than vegetation and fire histories, and there is scope for more studies of coastal Queensland and the Coral Sea to be written. My review suggests that oral sources can provide distinctive data about environmental history, although they must be interpreted with caution and, where possible, triangulated with documentary sources. While oral history has been used in several Australian environmental histories, it has not been used extensively to investigate coastal or marine areas in Queensland. In Section 2.5, I review studies that describe changes in the Great Barrier Reef, including two environmental histories of the Great Barrier Reef.

¹⁷⁸ Powell, 'A legacy of competing imperatives', p. 89.

¹⁷⁹ Dovers, 'Australian environmental history'; Powell, 'A legacy of competing imperatives', p. 89.

¹⁸⁰ J. Russell, 'Relating heritage to the environment in Australia', *Environmental History Review*, Vol. 15, No. 3, 1991, pp. 65-82, p. 65.

¹⁸¹ Powell, 'Historical geography'.

2.5 Environmental histories of the Great Barrier Reef

The Great Barrier Reef and the coral reefs of Torres Strait have been the subject of extensive research, especially since the creation of the GBRMP in 1975; the reefs of Torres Strait, however, lie outside the boundaries of the GBRWHA and do not form part of my review of literature. Many scientific studies of the Great Barrier Reef exist, including many studies of the ecology and management of the ecosystem, environmental changes in its habitats, and its geological history. This vast scientific literature of the Great Barrier Reef has been summarised in several bibliographies and reviews (Table 2.8), such as the bibliography of the Great Barrier Reef by Frankel which contains an overview of the literature of the Great Barrier Reef to 1978 and which also lists other, more specialised bibliographies.¹⁸² One specialist work, which focused on the Cairns Section of the GBRMP, was produced by the GBRMPA in 1982; that bibliography lists both academic and popular sources, including books, maps and articles about the Great Barrier Reef, but it excluded general overviews of the Great Barrier Reef apart from the works of some early European explorers.¹⁸³

In addition to these bibliographies, one atlas of the Great Barrier Reef was produced, by Maxwell, which remains the only scholarly atlas of the Great Barrier Reef and which contains detailed geological accounts of the structure and formation of the reefs. Australian maritime claims to the Great Barrier Reef were discussed in a study by Prescott, and Hopley *et al.* considered several issues of mapping and defining the Great Barrier Reef. Puotinen *et al.* produced a comprehensive atlas of tropical cyclones in the Great Barrier Reef region between 1969 and 1997, which represents another work at the scale of the entire Great Barrier Reef.¹⁸⁴ The content of those bibliographies and atlases is not repeated here. Instead, in this section, a selection of works that have examined environmental changes in the Great Barrier Reef is reviewed; as yet, no bibliographies or atlases of the environmental history of the Great Barrier Reef have been produced, and studies of the environmental history of the Great Barrier Reef are scarce.

¹⁸² E. Frankel, *Bibliography of the Great Barrier Reef Province*, AGPS, Canberra, 1978.

¹⁸³ GBRMPA, *Cook, cays and corals: a bibliography of publications about the Great Barrier Reef Marine Park Cairns Section*, GBRMPA, Townsville, 1982.

¹⁸⁴ Maxwell, *Atlas of the Great Barrier Reef*; J. R. V. Prescott, ‘Australia’s maritime claims and the Great Barrier Reef’, *Australian Geographical Studies*, Vol. 19, 1981, pp. 99–106; D. Hopley *et al.*, ‘The GBRMP: dimensions and regional patterns’, *Australian Geographical Studies*, Vol. 27, No. 1, 1989, pp. 47–66; Puotinen *et al.*, *Atlas of tropical cyclones*.

(a) SCIENTIFIC WORKS

(i) <i>Bibliographies/atlasses</i>	(ii) <i>Coral reef evolution</i>	(iii) <i>Evolution of the GBR</i>
Maxwell (1968)	Fagerstrom (1988)	Darwin (1842)
Frankel (1978)	Webb (1998)	Dana (1872)
GBRMPA (1982)	Wood (1999)	Agassiz (1913)
Puotinen <i>et al.</i> (1997)	Woodroffe <i>et al.</i> (2000)	Dakin (1950)
	Stanley (2001)	Hopley (many works)
		Davies <i>et al.</i> (1987)
		Flood (1992)
(iv) <i>Specific GBR locations</i>	(v) <i>Fringing/inshore reefs</i>	(vi) <i>Changes in corals</i>
Hopley (1978)	Bird (1971)	Hopley (1988)
Mather and Bennett (1978)	Baldwin (1987)	Pulsford (1993)
Smith (1978)	Craik and Dutton (1987)	Larcombe <i>et al.</i> (1995)
Stoddart and Yonge (1978)	Hopley (1988)	Wachenfeld (1995, 1997)
Heatwole (1981, 1984)	Ayling and Ayling (1991)	van Woesik and Done (1996)
Ward and Saenger (1984)	Ayling and Ayling (1998)	Wachenfeld <i>et al.</i> (1998)
Brennan (1988)	Larcombe <i>et al.</i> (1995)	Berkelmans and Oliver (1999)
Hopley <i>et al.</i> (1989)	van Woesik <i>et al.</i> (1996)	Larcombe and Woolfe (1999)
Baxter (1990)	Larcombe and Woolfe (1999)	McCook (1999)
Mapstone <i>et al.</i> (1992)	Chin and Ayling (2000)	Hoegh-Guldberg (2001)
(vii) <i>GBR fauna and flora</i>	(viii) <i>GBR Management</i>	
Hedley (1924)	Hopley (1988)	
Stephenson <i>et al.</i> (1958)	Dineson and Oliver (1997)	
Endean (1974)	Lucas <i>et al.</i> (1997)	
Limpus (many works)	Lawrence <i>et al.</i> (2002)	
Marsh (many works)	Furnas (2003)	
Harriott (2001)		
Jackson <i>et al.</i> (2001)		
Marsh <i>et al.</i> (2002)		

(b) OTHER HISTORIES

(ix) <i>Marine histories</i>	(x) <i>Environmental histories of the GBR</i>
Jack (1921)	Bowen (1994)
Holthouse (1976)	Bowen and Bowen (2002)
Pocock (2003)	

Table 2.8. A selection of types of literature of the Great Barrier Reef.

The scientific literature of environmental changes in the Great Barrier Reef is diverse and extensive, and can be subdivided into studies that consider the geological history or geomorphology of the entire Great Barrier Reef; studies that investigate particular regions, locations or periods; and studies that focus on specific environmental changes, such as changes in individual species. I review these types of studies briefly in turn below. The geological history of the Great Barrier Reef has been considered in many studies of the age, origin and evolution of the modern coral reefs. These studies are placed in context by others that describe the geological history and evolution of ancient reefs: for example, works by Fagerstrom, Wood and Stanley, which include references to the Great Barrier Reef.¹⁸⁵ Other works that contextualise the history of the Great Barrier Reef include a collection of geomorphological studies, by Carter and Woodroffe, which places the evolution of the Great Barrier Reef in the context of coastal evolution; an account of the natural history of coral reefs, by Sheppard; and a description of the growth of coral reefs in Torres Strait, by Woodroffe *et al.*¹⁸⁶ These studies suggest that the environmental history of the Great Barrier Reef belongs within a more extensive spatial and temporal narrative of environmental changes.

Scientific descriptions of the age, origin and evolution of the Great Barrier Reef date back to early accounts, by Darwin, Dana and Agassiz, of the formation of the Great Barrier Reef as a result of the subsidence of the Australian continent; Reclus, similarly, attempted to explain the formation the ‘coralline formations’ of the Great Barrier Reef in his account of Australasian geography.¹⁸⁷ More recently, other authors have discussed the geological history of the Great Barrier Reef, including Dakin, Gillett and McNeill, Maxwell and Bennett; the last author provided an overview of the Great Barrier Reef, including its development and use by humans, and argued that extensive transformations of specific environments in the Great Barrier Reef – such as Heron Island – have occurred as a result of increasing tourism, industry and agriculture on

¹⁸⁵ J. A. Fagerstrom, *The evolution of reef communities*, John Wiley and Sons, New York, 1988; R. Wood, *Reef evolution*, Oxford University Press, Oxford, 1999; G. D. Stanley, *The history and sedimentology of ancient reef systems*, Kluwer Academic/Plenum Publishers, New York 2001.

¹⁸⁶ R. W. G. Carter and C. D. Woodroffe (eds), *Coastal evolution: Late Quaternary shoreline morphodynamics*, Cambridge University Press, Cambridge, 1994; C. R. C. Sheppard, *A natural history of the coral reef*, Blandford Press, Poole, 1983; C. D. Woodroffe *et al.*, ‘Holocene reef growth in Torres Strait’, *Marine Geology*, Vol. 170, Nos. 3-4, 2000, pp. 331-346.

¹⁸⁷ C. Darwin, *The structure and distribution of coral reefs*, Smith, Elder and Co., London, 1842; J. D. Dana, *Corals and coral islands*, Sampson Low, London, 1872; G. R. Agassiz (ed), *Letters and recollections of Alexander Agassiz*, Houghton Mifflin, Boston, 1913; Reclus, *Australasia*, p. 30.

adjacent coastal land.¹⁸⁸ Many other geological and geomorphological accounts of environmental changes in the Great Barrier Reef have explored specific topics in more detail; seminal works include Hopley's accounts of the evolution of the Great Barrier Reef, changing sea levels, the evolution of the Great Barrier Reef and the hydro-isostatic adjustment of the continental coast during the Holocene: subjects which have also received attention from Thom and Chappell, Davies *et al.* and Flood.¹⁸⁹ Another account that extends its narrative beyond the historical period is Lough and Barnes' geochemical analysis of *Porites* skeletons, which suggests that continuous variability in coral growth rates has taken place in the Great Barrier Reef since 1492; hence, the historical impacts on coral reefs that have occurred since European settlement, described in Sections 5.3-5.7, belong in a context of considerable natural variability.¹⁹⁰

In addition to those scientific accounts of the evolution of the entire Great Barrier Reef, environmental changes in the ecosystem that can be attributed to atmospheric factors have been investigated by several authors. Evidence of coral bleaching was presented by Berkelmans and Oliver, and Hoegh-Guldberg produced a detailed discussion of the impacts of increasing global temperature on the Great Barrier Reef. Many accounts of the impacts of tropical cyclones on the Great Barrier Reef have been written, including works by Hopley, Puotinen *et al.*, Nott and Hayne, and Nott, which indicate that coral reefs experience dramatic episodic disturbances by cyclones.¹⁹¹ In an innovative study, Lough investigated both cyclone occurrences and sea surface temperature (SST) in the Great Barrier Reef since 1960 and compared that ecosystem with coral reefs in north-

¹⁸⁸ W. J. Dakin, *Great Barrier Reef: and some mention of other Australian coral reefs*, Australian National Publicity Association, Melbourne, 1950; K. Gillett and F. McNeill, *The Great Barrier Reef and adjacent isles*, The Coral Press, Paddington, 1959; Maxwell, *Atlas of the Great Barrier Reef*; I. Bennett, *The Great Barrier Reef*, Lansdowne Press, Sydney, 1971.

¹⁸⁹ D. Hopley, 'Sea level change on the Great Barrier Reef: an introduction', in D. R. Stoddart and M. Yonge (eds), *The northern Great Barrier Reef: philosophical transactions of the Royal Society of London*, Part A, Vol. 291, 1978, pp. 159-166; B. G. Thom and J. Chappell, 'Holocene sea level change: an interpretation', in Stoddart and Yonge (eds), *Northern Great Barrier Reef*, pp. 187-194; P. J. Davies *et al.*, 'Horizontal plate motion: a key allocyclic factor in the evolution of the Great Barrier Reef', *Science*, Vol. 238, 1987, pp. 1697-1700; P. G. Flood, 'Development of the Great Barrier Reef', in Smith (ed), *The unique continent*, pp. 45-52; D. Hopley, *The geomorphology of the Great Barrier Reef: Quaternary development of coral reefs*, John Wiley and Sons, New York, 1982; D. Hopley, 'Continental shelf reef systems', in Carter and Woodroffe (eds), *Coastal evolution*, pp. 303-340.

¹⁹⁰ J. M. Lough and D. J. Barnes, 'Centuries-long records of coral growth on the Great Barrier Reef', in Wachenfeld *et al.* (eds), *State of the GBRWHA Workshop*, pp. 149-157, p. 149.

¹⁹¹ R. Berkelmans and J. K. Oliver, 'Large-scale bleaching of corals on the Great Barrier Reef', *Coral Reefs*, Vol. 18, No. 1, 1999, pp. 55-60; Hoegh-Guldberg, *Climate change*; D. Hopley, 'Coastal changes produced by Tropical Cyclone Althea in Queensland, December 1971', *The Australian Geographer*, Vol. 12, No. 5, 1974, pp. 445-456; Puotinen *et al.*, *Atlas of tropical cyclones*; Nott and Hayne, 'High frequency'; Nott, 'Intensity of prehistoric tropical cyclones'.

western Australia.¹⁹² All of these works indicate that the coral reefs of the Great Barrier Reef experience periodic natural disturbances, although those disturbances may be exacerbated – or the recovery of coral reefs may be hindered – by human activity.

The studies mentioned above consider the entire Great Barrier Reef; in contrast, many works focus on regions and particular locations within the Great Barrier Reef. One early collection of analyses of the northern Great Barrier Reef, edited by Stoddart and Yonge, included studies of sedimentation, geological history and sea level changes in the northern Great Barrier Reef.¹⁹³ Ward and Saenger edited a later collection of works about the Capricornia Section of the GBRMP, which included histories of its geology, shorelines and cays and which included both geological and ecological perspectives towards environmental changes in those features. Another study of the southern Great Barrier Reef, which described many ecological variations in the corals at fringing reefs of continental islands, was carried out by van Woesik.¹⁹⁴ For the Townsville region, Hopley edited a collection of geographical analyses, including several studies of Wheeler Reef that described the movement of the cay, and coral growth, at that reef; accounts of ecological changes in several islands within the Great Barrier Reef have also been written for Green, Magnetic and One Tree Islands.¹⁹⁵

Accounts of changes in fringing reefs form another subset of the scientific literature of the Great Barrier Reef. An important, comparatively early example is Bird's study of the Holocene development of the fringing reefs near Yule Point, in north Queensland, as a result of eustatic changes in sea level.¹⁹⁶ Other examples include the collection of studies compiled by Baldwin for the GBRMPA Fringing Reef Workshop in 1986,

¹⁹² J. M. Lough, 'Coastal climate of northwest Australia and comparisons with the Great Barrier Reef: 1960 to 1992', *Coral Reefs*, Vol. 17, No. 4, 1998, pp. 351-367.

¹⁹³ Stoddart and Yonge (eds), *Northern Great Barrier Reef*.

¹⁹⁴ W. T. Ward and P. Saenger (eds), *The Capricornia Section of the Great Barrier Reef: past, present and future*, Royal Society of Queensland and ACRS, Brisbane 1984; R. van Woesik, 'Ecology of coral assemblages on continental islands in the southern section of the Great Barrier Reef, Australia', PhD Thesis, JCU, Townsville, 1992.

¹⁹⁵ I. N. Baxter, *Green Island information review*, Research Publication No. 25, GBRMPA, Townsville 1990; D. Hopley (ed), *Geographical studies of the Townsville area*, Monograph Series, Occasional Paper No. 2, Department of Geography, JCU, Townsville 1978; A. S. Smith, 'Magnetic Island and its fringing reefs', in Hopley (ed), *Geographical studies*, pp. 59-64; B. D. Mapstone *et al.*, *The fringing reefs of Magnetic Island: benthic biota and sedimentation – a baseline study*, Research Publication No. 13, GBRMPA, Townsville, 1992; H. Heatwole, *A coral island: the story of One Tree Island and its reef*, Collins, Sydney, 1981.

¹⁹⁶ E. C. F. Bird, 'The fringing reefs near Yule Point, north Queensland', *Australian Geographical Studies*, Vol. 9, 1971, pp. 107-115.

Ayling and Ayling's ecological studies of changes in the Cape Tribulation and Snapper Island fringing reefs, a study of fringing reefs at Magnetic Islands by Mapstone *et al.*, and a study of the disturbance and recovery of fringing reefs in the Cairns Section of the GBRMPA by Chin and Ayling.¹⁹⁷ These authors used scientific techniques to analyse environmental changes in, and to assess human impacts on, fringing reefs. Craik and Dutton described the monitoring of fringing reefs at Cape Tribulation, acknowledging that significant attention has been paid to the reconstruction of impacts in that environment.¹⁹⁸ Of the works mentioned above, Baldwin's collection of studies represents a particularly important work: it includes accounts of coral reef zonation, geomorphology, development, water quality and coral growth in relation to fringing reefs. In general, the accounts mentioned above focus most frequently on the geological evolution of fringing reefs, although some attention has been given to human impacts, such as the construction of boat harbours. These accounts are also scientific in their approach and do not constitute environmental history in the strict sense, because their focus is not the changing relationship between the coral reefs and human societies.

Scientific studies of environmental changes in the Great Barrier Reef can also be categorised by topic. Many studies of changes in the corals of the Great Barrier Reef have been produced, including the account of anthropogenic influences on coral and coral reefs by Hopley, which describes many human impacts in the Great Barrier Reef, including guano mining, tourist resort development and shipping.¹⁹⁹ Examples of other, ecological accounts of changes in coral reefs are numerous in the literature; these accounts include works by van Woesik, van Woesik and Done, and McCook, and they indicate the ecological complexity of the Great Barrier Reef and the problems involved in identifying causes of changes in corals. In contrast to the studies mentioned above – all of which use quantitative methods – Wachenfeld used historical photographs to analyse environmental changes in coral reefs and he concluded that changes were highly

¹⁹⁷ C. L. Baldwin (ed), *Fringing reef workshop: science, industry and management*, Proceedings of a workshop held at Arcadia Resort, Magnetic Island, Australia, October 23-25, 1986, GBRMPA, Townsville, 1986; A. M. Ayling and A. L. Ayling, *The effect of sediment run-off on the coral populations of fringing reefs at Cape Tribulation*, Research Publication No. 26, GBRMPA, Townsville, 1991; A. M. Ayling and A. L. Ayling, *The effect of the Daintree River flood plume on Snapper Island coral reefs*, Research Publication No. 53, GBRMPA, Townsville, 1998; Mapstone *et al.*, *Fringing reefs*; A. Chin and A. Ayling, 'Disturbance and recovery cycles: long-term monitoring on 'unlucky' inshore fringing reefs in the Cairns Section of the GBRMP', *Reef Research*, Vol. 10, No. 1, March 2000, pp. 5-8.

¹⁹⁸ W. Craik and I. Dutton, 'Cape Tribulation fringing reefs and monitoring program', in Baldwin, *Fringing Reef Workshop*, 77-82.

¹⁹⁹ Hopley, 'Anthropogenic influences'.

variable between reefs; nevertheless, the photographs indicated that some reefs, including those at Stone Island, Fitzroy Island, Michaelmas Cay and Bramston Reef, have experienced dramatic reductions in coral cover during the twentieth century.²⁰⁰

Many recent accounts have considered changes in water quality in the GBRWHA. Larcombe *et al.* and Larcombe and Woolfe considered sedimentation on coral reefs and argued that turbidity in the Great Barrier Reef lagoon is controlled by natural factors and has not been exacerbated by human activity.²⁰¹ Their argument is contested by others authors, including the authors of the scientific reports on water quality listed in Table 1.1, who argued that the impacts of terrestrial runoff – and, in particular, the effects of nutrient enhancement of Queensland coastal waters – has considerably degraded the Great Barrier Reef (Section 1.2). Other studies that indicate that terrestrial activities have affected the Great Barrier Reef during the period of European settlement include works by Pulsford, who investigated historical nutrient run-off in the GBRCA, and by King *et al.*, who modeled the impacts of river plumes on the Great Barrier Reef. Among such works, a detailed, extensive investigation of the impacts of terrestrial runoff on the GBRWHA and their management implications has been written by Furnas, who argued that an integrated approach to the management of the GBRCA is required if a significant improvement in degraded, inshore coral reefs is to occur.²⁰²

Numerous accounts of changes in marine biota have also been produced for the Great Barrier Reef. The earliest of those works pre-date the early studies of coral reef ecology, since they accompanied the development of the early reef fisheries in the Great Barrier Reef; one example is Hedley's popular account of the Great Barrier Reef pearl fisheries.

²⁰⁰ van Woesik, 'Ecology of coral assemblages'; R. van Woesik and T. J. Done, 'Coral communities and reef growth in the southern Great Barrier Reef', *Coral Reefs*, Vol. 16, No. 2, 1996, pp. 103-115; L. J. McCook, 'Macroalgae, nutrients and phase shifts on coral reefs: scientific issues and management consequences for the Great Barrier Reef', *Coral Reefs*, Vol. 18, No. 4, 1999, pp. 357-367; Wachenfeld, 'Report of the Historical Photographs Project'; Wachenfeld, 'Long-term trends', p. 134.

²⁰¹ P. Larcombe *et al.*, 'Factors controlling suspended sediment on inner-shelf coral reefs, Townsville, Australia', *Coral Reefs*, Vol. 14, No. 3, 1995, pp. 163-171; P. Larcombe and K. J. Woolfe, 'Increased sediment supply to the Great Barrier Reef will not increase sediment accumulation at most coral reefs', *Coral Reefs*, Vol. 18, No. 2, 1999, pp. 163-169.

²⁰² J. S. Pulsford, *Historical nutrient usage in coastal Queensland river catchments adjacent to the GBRMP*, Research Publication No. 40, GBRMPA, Townsville, 1996; B. King *et al.*, *Modelling the impact of the Burdekin, Herbert, Tully and Johnstone River Plumes on the central Great Barrier Reef*, CRC Reef Research Technical Report No. 41, CRC Reef, Townsville, 2002; Williams, *Impacts of terrestrial run-off*, Productivity Commission, *Industries, land use and water*; Furnas, *Catchments and corals*.

In contrast to Hedley's account, an early scientific work was the survey of the marine fauna of the Low Isles, by Stephenson *et al.*, which provided a detailed ecological baseline of biota at that reef.²⁰³ Since those works, much more extensive consideration has been given to changes in marine fauna. Many works about changes in dugong populations in the Great Barrier Reef have been written by Marsh and numerous co-authors: those works indicate that a localised reduction in dugong numbers may have occurred in the Lockhart River area, and that a dramatic reduction in dugong numbers to the south of Cooktown, has taken place since scientific monitoring of dugongs commenced.²⁰⁴ Changes in marine turtle populations have been investigated by Limpus, who drew attention to the importance of conserving marine turtle habitats such as the significant rookery at Bramble Cay. Many studies of fish populations in the Great Barrier Reef exist, including one reconstruction, by Jackson *et al.*, that indicates severe depletion of many fisheries since European settlement. However, Harriott evaluated the Great Barrier Reef coral harvest fishery, arguing that the industry currently operates within sustainable limits, in contrast to historical coral collecting (Section 5.5).²⁰⁵

In addition to those accounts of changes in different aspects of the Great Barrier Reef, other works relate to the management of the ecosystem. One study, the *Coastal Management Investigation*, was produced shortly after the formation of the GBRMP and considered changes in the Queensland coast between Innisfail and Mossman.²⁰⁶ A more recent work with a management focus is the account by Lawrence *et al.*, which

²⁰³ C. Hedley, 'Australian pearl fisheries', *Australian Museum Magazine*, Vol. 2, 1924, p. 5-11; W. Stephenson *et al.*, 'An ecological survey of the marine fauna of Low Isles, Queensland', *Australian Journal of Marine Freshwater Resources*, Vol. 9, 1958, pp. 261-318.

²⁰⁴ H. Marsh, 'Progress towards the sustainable use of dugongs by Indigenous peoples in Queensland', in M. Bomford and J. Caughley (eds), *The sustainable use of wildlife by Aboriginal and Torres Strait Islander People*, AGPS, Canberra, 1996, pp. 139-151; H. Marsh and P. Corkeron, 'Natural heritage attribute: marine mammals', in Lucas *et al.* (eds), *Outstanding universal value*, pp. 159-161, p. 160; H. Marsh and P. Corkeron, 'The status of the dugong in the GBRMP', in Wachenfeld *et al.* (eds), *State of the GBRWHA Workshop*, pp. 231-247, pp. 239-240; H. Marsh *et al.*, 'The sustainability of the Indigenous dugong fishery in Torres Strait, Australia/Papua New Guinea', *Conservation Biology*, Vol. 11, No. 6, 1997, pp. 1375-1386; H. Marsh, 'Evaluating management initiatives aimed at reducing the mortality of dugongs in gill and mesh nets in the GBRWHA', *Marine Mammal Science*, Vol. 16, No. 3, 2000, pp. 684-694; H. Marsh *et al.*, *Dugong: status reports and action plans for countries and territories*, UNEP, Nairobi, 2002; H. Marsh, *An integrated framework for the conservation of dugongs and dugong hunting cultures in northern Australia*, Report to the GBRMPA, JCU, Townsville, 2003.

²⁰⁵ C. J. Limpus, 'The Green Turtle, *Chelonia mydas*, in Queensland, Australia: the Bramble Cay rookery in the 1979-1980 breeding season', *Chelonian Conservation and Biology*, Vol. 4, No. 1, 2001, pp. 34-46; Jackson *et al.*, 'Historical overfishing'; V. J. Harriott, *The sustainability of Queensland's coral harvest fishery*, CRC Reef Research Centre Technical Report No. 40, CRC Reef, Townsville, 2001.

²⁰⁶ P. G. Pak-Poy and Associates, *Coastal management investigation: Innisfail to Mossman*, Technical Report, P. G. Pak-Poy and Associates, Cairns, 1976.

provided a detailed history of the creation and management of the GBRMP and the development of the original zoning plan; this text included a brief historical account of the development of the Queensland coast and the exploration and charting of the Great Barrier Reef. These works consider the management of large marine areas; many works suggest management implications for particular topics within these areas, such as the study, by Dinesen and Oliver, which investigated the management of tourism impacts on the ecosystem, arguing that those impacts have been both cumulative and geographically concentrated within the GBRWHA.²⁰⁷

The studies listed above represent a small selection of the extensive scientific literature relating to the Great Barrier Reef; most of those studies, however, are not strictly works of environmental history because they do not focus on the changing relationship between humans and the Great Barrier Reef. The brief review of literature provided above serves only to exemplify the many scientific accounts of environmental changes in the Great Barrier Reef that have been written, in contrast to qualitative histories of the Queensland coast, including histories of marine industries and accounts of the exploration, charting and navigation of Queensland coastal waters.²⁰⁸ While the latter group does not consist entirely of scholarly accounts, those works contain useful accounts of human exploitation of the Great Barrier Reef; one account, by Love, used documentary and oral sources to narrate several aspects of the history of the Great Barrier Reef: early European exploration, guano mining, scientific investigation and the green turtle fishery.²⁰⁹ Such works do not claim to be environmental histories and they do not attempt to narrate the history of the Great Barrier Reef from an environmental perspective or to focus on the changing relationships between humans and coral reefs.

The only definitive environmental histories of the Great Barrier Reef previously written are the works by Bowen and by Bowen and Bowen.²¹⁰ Bowen provided an overview of the environmental history of the Great Barrier Reef, acknowledging not only the

²⁰⁷ Lawrence *et al.*, *Great Barrier Reef*; Z. Dineson and J. Oliver, ‘Tourism impacts’, in Wachenfeld *et al.* (eds), *State of the GBRWHA Workshop*, pp. 414-427.

²⁰⁸ R. L. Jack, *Northmost Australia: three centuries of exploration, discovery and adventure in and around Cape York Peninsula, with a study of the narratives of all explorers by sea and land in the light of modern charting*, Simphin, Marshall and Hamilton, London, 1921; H. Holthouse, *Ships in the coral*, Macmillan, Melbourne, 1976.

²⁰⁹ R. Love, *Reefscape: reflections on the Great Barrier Reef*, Allen and Unwin, St. Leonards, New South Wales, 2000.

²¹⁰ Bowen, ‘Great Barrier Reef’; Bowen and Bowen, *Great Barrier Reef*.

expansion of European industries but also the perceived mystique of the Great Barrier Reef for European settlers. His environmental history considered the period between 1770 and 1994, including early surveys of the coral reefs, pearl-shelling, expansion and settlement in the adjacent coastal districts, and the importance of sugar cane farming and fishing. His account also described particular human impacts at Wreck and Heron Islands, conflicts between oil prospectors and conservationists, Crown of Thorns Starfish (COTS) outbreaks and the proposal to mine Ellison Reef for coral lime. Bowen also described the formation of the GBRMP in 1975. While his text represents the first study by an environmental historian of the use and management of the Great Barrier Reef, it focused on human perceptions of, and responses to, the ecosystem rather than on documenting changes in the coral reefs or their associated species.²¹¹

Bowen's environmental history was developed in a second environmental history of the Great Barrier Reef, which represents the first extensive environmental history of the Great Barrier Reef; for, as Bowen and Bowen stated:

The Great Barrier Reef, Australia's most outstanding natural feature, has captured the interest of scientists and tourists from around the world. Yet surprisingly, despite its immense attraction, scientific importance and heritage value, no single, comprehensive account of its fascinating history has ever been published.²¹²

Bowen and Bowen traced the history of European encounters with the Great Barrier Reef, including the period of early European exploration, hydrography and navigation. Their narrative then covers the evolution of natural history and scientific observation of the Great Barrier Reef, and the development of marine industries based on that knowledge: pearl-shell, trochus and bêche-de-mer. In particular, the importance of the pearl and pearl-shell industries – and the subsequent depletion of pearl stocks – was acknowledged by these authors. Bowen and Bowen then considered the growth of ideas about conservation and heritage in relation to the Great Barrier Reef, including the significance of the scientific expeditions to Low Isles, the activities of individual scientists and the environmental controversies that were prominent after 1945. The text concluded with an outline of the formation of the GBRMP and the GBRWHA, and with an evaluation of significant contemporary issues in the management of the GBRWHA.

²¹¹ Bowen, 'Great Barrier Reef', *passim*.

²¹² Bowen and Bowen, *Great Barrier Reef*, p. xii.

These two works are innovative as they are the only previously-written environmental histories of the Great Barrier Reef; in particular, the later work represents a detailed narrative of the unfolding relationship between Europeans and the Great Barrier Reef. However, they also have several limitations. First, the earlier study focused on the outer Great Barrier Reef and contains few references to inshore locations, other than the Great Barrier Reef Expedition to Low Isles in 1928-1929; similarly, the later work contains a general emphasis on the outer Great Barrier Reef.²¹³ Hence, a more detailed narrative of the environmental history of inshore habitats in the Great Barrier Reef could be written. Second, while Bowen and Bowen used an array of qualitative sources, some sources – including the archival records of the Queensland Department of Harbours and Marine (QDHM), and oral histories – were little used; archival research and the collection of original oral histories could inform a different historical narrative. Third, neither study focused on the Indigenous history of the Great Barrier Reef, yet accounts of environmental changes that have been observed by Indigenous Australians could provide another environmental history narrative of the Great Barrier Reef for the period since European settlement. Therefore a research gap exists for other environmental histories of the Great Barrier Reef; my study provides alternative narratives based on the use of archival and oral history research (Chapters 5-7).

2.6 Conclusion

In this chapter, I have reviewed the literature of the sub-discipline of environmental history, defining the academic field and tracing its evolution (Sections 2.2-2.3). In particular, I have discussed Cronon's narrative approach, in which environmental history is the production of narratives about the changing relationships between humans and the environment, although I have also described some of the diversity and various tensions that characterise the modern sub-discipline (Section 2.3).²¹⁴ My overview of Australian environmental histories reveals that Australian studies have frequently described south-eastern, terrestrial environments and have focused on the topics of forestry, soils and land degradation, although many water histories have also been produced by Australian scholars (Section 2.4). In contrast, I have shown that few environmental histories of coastal and marine environments have been written, and that

²¹³ Bowen, 'Great Barrier Reef', p. 237.

²¹⁴ Cronon, 'A place for stories'.

environmental histories of the Great Barrier Reef are scarce. The brief review of a selection of studies of the Great Barrier Reef provided in Section 2.5 illustrates the types of scientific and other works that describe changes in the ecosystem, yet those works do not constitute environmental history because they do not focus on the changing relationships between the Great Barrier Reef and human societies.

The two environmental histories of the Great Barrier Reef written by Bowen and Bowen and Bowen provide valuable and innovative narratives of the European exploration, investigation and conservation of that ecosystem; but I have argued that those works did not make extensive use of archival evidence and oral history sources; nor do those accounts contain Indigenous perspectives towards changes in the Great Barrier Reef. Therefore, those works leave scope for my account, based on extensive archival and oral history research, which provides additional details of environmental changes in parts of the Great Barrier Reef that are not described by Bowen or Bowen and Bowen. For example, the account of turtle farming in Torres Strait found in Section 7.3 and the accounts of coral and shell collecting presented in Sections 5.5 and 5.6 represent original findings that have not been described in previous environmental history texts. My account of coral mining presented in Section 5.4 also contains original material obtained from archival and oral history research. Therefore, my study has benefited from – but has also extended – those earlier accounts. In their evaluation of Australasian environmental history, Robin and Pawson stated that:

scholarship has revealed a much greater extent of environmental transformation by Indigenous people than we had imagined, and it has discovered much longer cycles of environmental ups and downs with which the colonial moment has sometimes unknowingly interacted.²¹⁵

The same observation applies to my story of changes in the Great Barrier Reef for the period 1860-1970, which also describes a ‘colonial moment’ of interactions between European settlers and a dynamic ecosystem, and which also belongs within a context of natural variability, Indigenous impacts and the emergence of the world economy.

²¹⁵ L. Robin and T. Griffiths, ‘Environmental history in Australasia’, *Environment and History*, Vol. 10, 2004, pp. 439-474, p. 458.

3. RECONSTRUCTING THE PAST: A METHODOLOGY

Qualitative research is defined in many ways, includes a multitude of approaches and techniques, and makes use of diverse empirical materials. In this chapter, I explain the methodology used in my research, which is based on the philosophical approach developed by Denzin and Lincoln; and their definition is compared with a selection of other definitions of qualitative research. I have used an array of qualitative methods in my research, although textual analysis of archival documents and semi-structured interviewing form the dominant techniques. Details about the sources of data, methods of data collection and analysis, and issues of data storage and protection are provided in this chapter, and I also discuss some ethical issues involved in qualitative research.

3. RECONSTRUCTING THE PAST: A METHODOLOGY

3.1 Introduction

The review of the literature presented in Chapter 2 suggests that extensive scientific literature about the Great Barrier Reef has been collected for the period since 1970, but that fewer scientific data illuminate the period 1860-1970: the period with which my research is most concerned. My review of literature also suggests that qualitative sources can provide original information about the environmental history of the Great Barrier Reef for that earlier period; potentially valuable qualitative sources of data include archival and oral history sources, which have been little used in previous environmental histories of the Great Barrier Reef. My research used an array of qualitative sources and methods to reconstruct changes in coral reefs, islands and marine wildlife species for the period 1860-1970. However, the use of qualitative methods required a distinctive approach and raised specific methodological issues, especially the importance of triangulation of sources. In this chapter, I describe and explain the methodology adopted in my research: the use of qualitative sources in the production of an environmental history narrative for the Great Barrier Reef.

In Section 3.2, I define qualitative research and explain the approach used in my research. Different sources of qualitative data are discussed next, in Section 3.3. Section 3.4 contains an account of my methods of data collection, including semi-structured interviewing and archival searches. Section 3.5 contains the details of the methods of analysis, presentation and protection of my data, as well as some ethical considerations relating to my work. In this chapter, I also explain the distinctive characteristics of qualitative methods and their suitability for my study. Two main types of qualitative sources were used – documentary and oral history sources – including historical books, leaflets, maps, photographs, Queensland Government records and reports, newspapers and oral history interviews; but, of these, I emphasise the particular importance of archival and oral history evidence. Some limitations of qualitative sources – including their subjectivity, bias and partial coverage – are also mentioned: and some responses to those limitations, including triangulation and the use of expert advice.

3.2 Defining qualitative research

Many definitions of qualitative research exist; Tables 3.1-3.3 present thirty-four of those definitions, arranged in three main groups: qualitative research as a field of academic inquiry (Table 3.1), as interpretive inquiry (Table 3.2) and as socially situated inquiry (Table 3.3). However, some of those definitions could be categorised in more than one group. For example, the definitions provided by Denzin and Lincoln belong within all of the groups described above.¹ Therefore, these categories provide a convenient means of analysing definitions of qualitative research, but are not prescriptive. Furthermore, the definitions presented in this section reveal significant diversity within the field of qualitative research; many different views of the nature, scope, subjects and approaches of qualitative research exist. Yet analysis of those definitions suggests that most focus on the interpretation of the meanings of phenomena using more than one method. Recent definitions also treat qualitative research as a process that considers the position of the researcher in a particular context. Such definitions correspond well with Cronon's narrative approach to environmental history that emphasises the position of the narrator.²

The first group of definitions regards qualitative research as a distinct field of academic inquiry (Table 3.1). In these definitions, qualitative research is not simply a set of generic practices but a discipline with its own history, particular traditions, conceptual centre and philosophical basis. Denzin and Lincoln argued that qualitative research is a specific field which crosses other disciplinary and field boundaries and unites a diverse group of terms, ideas and assumptions; qualitative research is also defined as the academic field that emerged from the recent methodological revolution in the social sciences in which a new emphasis was placed on interpretive approaches. That field represents part of the 'narrative turn' in the social sciences and is a modern, reformist movement.³ In these definitions, qualitative research is seen as an academic discipline in its own right – albeit one that informs other academic disciplines. However, Dey's work

¹ Denzin and Lincoln, 'Introduction'.

² Denzin and Lincoln, 'Introduction'; D. Ezzy, *Qualitative analysis: practice and innovation*, Allen and Unwin, Crows Nest, New South Wales, 2002, p. 81; Cronon, 'A place for stories', pp. 1350 and 1375.

³ Denzin and Lincoln, 'Introduction', p. 2; N. K. Denzin and Y. S. Lincoln (eds), *Handbook of qualitative research*, 2nd edn, Sage Publications, Thousand Oaks, California, 2000, pp. ix-x; T. A. Schwandt, 'Three

epistemological stances: interpretivism, hermeneutics, and social construction', in Denzin and Lincoln (eds), *Handbook*, pp. 189-213, p. 189.

Definition 1: Qualitative data ‘are a source of well-grounded, rich descriptions and explanations of processes occurring in local contexts.’

Source: Miles and Huberman (1984, p. 15).

Comment: These authors acknowledged that qualitative research involves researching many sites, using many methods, although they admitted that there was little consensus on methods of analysis of qualitative data.

Definition 2: ‘The term “qualitative research” in fact overlaps with others such as “field research”, “case study methods” and “ethnography”.’

Source: Finch (1986, p. 6).

Comment: Finch acknowledged an ambiguity in terminology; qualitative research refers both to the use of interviews to collect case studies and to a broader approach to research.

Definition 3: The term qualitative research refers to both ‘a particular research design’ and to ‘any research which does not produce purely quantitative data’.

Source: Hakim (1987, p. 8).

Comment: Hakim identified qualitative research with the collection of case studies using depth interviews or focus groups, although she also recognised a wider definition: any research that is not quantitative.

Definition 4: ‘Qualitative research normally looks for patterns of interrelationship between many categories rather than the sharply delineated relationship between a limited set of them.’

Source: McCracken (1988, p. 16)

Comment: McCracken contrasted qualitative research with quantitative research, in which categories are isolated and defined, as far as possible, before the study is commenced.

Definition 5: ‘Qualitative inquiry is an umbrella term for various philosophical orientations to interpretive research.’

Source: Glesne and Peshkin (1992, p. 9).

Comment: This definition suggests that qualitative research embraces many diverse methods and approaches, although all share an interpretive dimension.

Definition 6: ‘Qualitative research is an interdisciplinary, transdisciplinary, and sometimes counterdisciplinary field. It crosscuts the humanities and the social and physical sciences. Qualitative research is many things at the same time. It is multiparadigmatic in focus. Its practitioners are sensitive to the value of the multimethod approach.’

Source: Nelson *et al.* (1992, p. 4).

Comment: Nelson *et al.* treat qualitative research as a distinct academic field; these authors argued that the field is both a multi-voiced and a naturalistic – or humanistic – inquiry.

Definition 7: ‘Qualitative research embraces two tensions at the same time. On the one hand, it is drawn to a broad, interpretive, postexperimental, postmodern, feminist, and critical sensibility. On the other hand, it is drawn to more narrowly defined positivist, postpositivist, humanistic, and naturalistic conceptions of human experience and its analysis. Further, these tensions can be combined in the same project, bringing both postmodern and naturalistic or both critical and humanistic perspectives to bear.’

Source: Nelson *et al.* (1992, p. 4).

Comment: This definition highlights differences within the field of qualitative research; many approaches exist, which can be contradictory, with the result that qualitative research includes incompatible practices.

Definition 8: ‘Whereas quantitative data deals with numbers, qualitative data deals with meanings.’

Source: Dey (1993, p. 10)

Comment: Dey contrasted qualitative research with quantitative research, suggesting that qualitative research is an interpretive activity since it is concerned with meanings.

Definition 9: ‘There is no one kind of qualitative data analysis, but rather a variety of approaches, related to the different perspectives and purposes of researchers.’

Source: Dey (1993, p. 1)

Comment: This definition regards qualitative research as an umbrella term for many different, subjective approaches.

Definition 10: ‘There is no standard approach to qualitative [research].’

Source: Silverman (1993, p. 23)

Comment: Silverman acknowledged that qualitative research embraces different approaches, methods and definitions.

Definition 11: ‘By the term “qualitative research,” we mean any type of research that produces findings not arrived at by statistical procedures or other means of quantification.’

Source: Strauss and Corbin (1998, pp. 10-11).

Comment: These authors defined qualitative research as any inquiry that does not produce quantitative data, that provides interpretive analysis of quantitative data, or that is connected with the attempt to understand human experiences.

Definition 12: ‘Qualitative research is a field of inquiry in its own right. It crosscuts disciplines, fields, and subject matters.’

Source: Denzin and Lincoln (2000, p. 2).

Comment: These authors regarded qualitative research primarily as an interdisciplinary, yet distinct, academic field.

Definition 13: ‘Qualitative research involves the studied use and collection of a variety of empirical materials – case study; personal experience; introspection; life story; interview; artefacts; cultural texts and productions; observational, historical, interactional, and visual texts – that describe routine and problematic moments and meanings in individuals’ lives.’

Source: Denzin and Lincoln (2000, pp. 3-4).

Comment: These authors argued that all of the interpretive methods used in qualitative research are interconnected.

Definition 14: ‘The word qualitative implies an emphasis on the qualities of entities and on processes and meanings that are not experimentally examined or measured (if measured at all) in terms of quantity, amount, intensity, or frequency.’

Source: Denzin and Lincoln (2000, p. 8).

Comment: Denzin and Lincoln contrasted qualitative and quantitative research in this definition, stressing the emphasis on interpretation of meaning in the former type.

Definition 15: ‘Qualitative inquiry is the name for a reformist movement that began in the early 1970s in the academy. The movement encompassed multiple epistemological, methodological, political, and ethical criticisms of social scientific research in fields and disciplines that favored experimental, quasi-experimental, correlational, and survey research strategies.’

Source: Schwandt (2000, p. 189).

Comment: This definition treats qualitative research as a distinct field of inquiry in opposition to quantitative research. In contrast, Dey (1993, p. 28) disputed such an opposition, arguing that a combination of both approaches is valuable.

Table 3.1. Some definitions of qualitative research as an academic inquiry.

Definition 16: ‘The label qualitative methods has no precise meaning in any of the social sciences. It is at best an umbrella term covering an array of interpretive techniques which seek to describe, decode, translate, and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world. To operate in a qualitative mode is to trade in linguistic symbols and, by so doing, attempt to reduce the distance between indicated and indicator, between theory and data, between context and action. The raw materials of qualitative study are therefore generated *in vivo*, close to the point of origin.’

Source: van Maanen (1983, p. 9).

Comment: In this definition, qualitative research is a collection of interpretive methods; it is concerned with the meanings of phenomena, not their quantity nor frequency.,

Definition 17: ‘Qualitative research is concerned with individuals’ own accounts of their attitudes, motivations and behaviour. It offers richly descriptive reports of individuals’ perceptions, attitudes, beliefs, views and feelings, the meanings and interpretations given to events and things, as well as their behaviour; displays how these are put together, more or less coherently and consciously, into frameworks which make sense of their experiences; and illuminates the motivations which connect attitudes and behaviour, the discontinuities, or even contradictions, between attitudes and behaviour, or how conflicting attitudes and motivations are resolved in particular choices made. Although qualitative research is about people as the central unit of account, it is not about particular individuals per se; reports focus rather on the various patterns, or clusters, of attitudes and related behaviour that emerge from the interviews.’

Source: Hakim (1987, p. 26).

Comment: This definition stresses ways in which human interactions, attitudes and behaviours can be understood using individual accounts. Hakim argued that such accounts form the basic level of analysis, but that they should also be used to identify patterns of similar behaviours and attitudes.

Definition 18: Qualitative inquiry refers to ‘various philosophical orientations to interpretive research.’

Source: Glesne and Peshkin (1992, p. 9).

Comment: Glesne and Peshkin argued that qualitative research is characterised by an interpretive dimension.

Definition 19: ‘Qualitative research explores the poorly understood territories of human interaction. Like explorers who seek to identify and understand the biological and geological processes that create the patterns of a physical landscape, qualitative adventurers seek to describe and understand the processes that create the patterns of the human terrain.’

Source: Glesne and Peshkin (1992, p. 173).

Comment: While not defining qualitative research explicitly as interpretive practice, this definition focuses on the attempt to understand human experience through qualitative inquiry.

Definition 20: Qualitative researchers ‘are committed to [...] the interpretive understanding of human experience’

Source: Nelson et al. (1992, p. 4).

Comment: These authors considered qualitative research to be concerned with the interpretation of human experience.

Definition 21: Qualitative research ‘deals with meanings. Meanings are mediated mainly through language and action.’

Source: Dey (1993, p. 10)

Comment: Dey (1993) suggested that qualitative research is an interpretive activity because it is concerned with the meanings of phenomena.

Definition 22: Qualitative research ‘answers the question, ‘What is going on here? Qualitative research is designed to provide an impression; to tell what kinds or types of something there are; to tell what it is like to be, do or think something.’

Source: Bouma (1996, p. 169).

Comment: Bouma argued that qualitative research is concerned with human experiences and the attempt to convey an impression of those experiences.

Definition 23: Qualitative research ‘can refer to research about persons’ lives, lived experiences, behaviours, emotions, and feelings as well as about organizational functioning, social movements, cultural phenomena, and interactions between nations. Some of the data may be quantified as with census or background information about the persons or objects studied, but the bulk of the analysis is interpretive.’

Source: Strauss and Corbin (1998, pp. 10-11).

Comment: Strauss and Corbin stated that qualitative research provides interpretive analysis of quantitative data; they also linked qualitative research with the attempt to understand the meanings of human experiences.

Definition 24: ‘Qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them.’

Source: Denzin and Lincoln (2000, p. 3).

Comment: Denzin and Lincoln emphasised the production of representations through interpretive practice in qualitative research.

Definition 25: ‘Qualitative researchers employ a wide range of interconnected interpretive practices, hoping always to get a better understanding of the subject matter at hand. It is understood, however, that each practice makes the world visible in a different way. Hence there is frequently a commitment to using more than one interpretive practice in any study.’

Source: Denzin and Lincoln (2000, pp. 3-4).

Comment: This definition also explains the rationale for using several methods in research, as Denzin and Lincoln regarded all qualitative methods as being interconnected, since all are interpretive.

Definition 26: ‘Qualitative researchers study meaning.’

Source: Ezzy (2002, p. 81).

Comment: This definition suggests that qualitative research is concerned with the meanings of events, places and roles in human life. Qualitative research is interpretive practice; therefore, it is ambiguous, contingent, and contextual.

Definition 27: ‘Qualitative researchers are [...] concerned about issues of the richness, texture, and feeling of raw data because their inductive approach emphasizes developing insights and generalizations out of the data collected.’

Source: Neuman (2000, p. 122).

Comment: Neuman argued that qualitative research is interpretive, nonlinear, contextual and uses ‘a transcendent perspective’ towards the phenomena studied.

Table 3.2. Some definitions of qualitative research as interpretive inquiry.

Definition 28: ‘Qualitative researchers attempt to understand behavior and institutions by getting to know the persons involved and their values, rituals, symbols, beliefs, and emotions.’

Source: Frankfort-Nachmais and Nachmais (1992, pp. 271-272).

Comment: This definition focuses on the understanding of human behaviour and institutions through experience; it also suggests the value of experiential, subjective knowledge.

Definition 29: Qualitative research ‘is inherently political and shaped by multiple ethical and political positions.’

Source: Nelson *et al.* (1992, p. 4).

Comment: In this statement, the authors implied that qualitative research is a situated activity since it contains political and ethical dimensions.

Definition 30: ‘At the heart of the qualitative approach is the assumption that a piece of qualitative research is very much influenced by the researcher’s individual attributes and perspectives. The goal is not to produce a standardized set of results that any other careful researcher in the same situation or studying the same issues would have produced. Rather it is to produce a coherent and illuminating description of and perspective on a situation that is based on and consistent with detailed study of the situation.’

Source: Ward-Schofield (1993, p. 202)

Comment: This definition suggests that qualitative research produces a unique, situated, cultural text, as a result of the critical engagement of a researcher with a particular situation. Bailey *et al.* (1999, p. 172) argued that such reflexivity validates qualitative data, depending on the researcher’s ability to understand the research process and to question the stories of informants. The subjectivity of qualitative research is here regarded as a strength rather than as a weakness. Therefore, this is a unique definition that stresses the rich description secured by qualitative researchers.

Definition 31: ‘Qualitative researchers exercise great discipline in order to find out ‘What is going on here?’ from the perspective of those who are in the situation being researched.’

Source: Bouma (1996, p. 169).

Comment: Bouma emphasised the socially situated dimension of qualitative inquiry: the attempt to understand human experience as it is perceived by ‘others’, which necessarily implies the recognition of the position of the researcher.

Definition 32: ‘Qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible.

These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings, and memos’.

Source: Denzin and Lincoln (2000, p. 3).

Comment: This is a distinctive definition of qualitative research that focuses on the position of the researcher in taking part in socially situated inquiry. In this respect, the approach of Denzin and Lincoln is comparable with the narrative approach of Cronon (1992), in which the position of the narrator is crucial in the production of environmental histories.

Definition 33: ‘Qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry. Such researchers emphasize the value-laden nature of inquiry. They seek answers to questions that stress how social experience is created and given meaning.’

Source: Denzin and Lincoln (2000, p. 8).

Comment: These authors described many aspects of situated qualitative research: the social construction of nature, recognition of the position and concerns of the researcher, the context of inquiry, and the values involved in research.

Definition 34: ‘Qualitative research is done through establishing relationships with people, places and performances. The best qualitative researchers do not separate their lives from their research, as if people could be understood through distancing ourselves from them. Qualitative research, and qualitative data analysis, involves working out how the things that people do make sense from their perspective. This can be done only by entering into their world, so that their world becomes our world [...] the interpretive process at the heart of qualitative data analysis involves trying to understand the practices and meanings of research participants from their perspective. Qualitative observation, and data analysis, is best done when the observer becomes part of the dance. Conducting qualitative research is about participating in other people’s lives and writing about that participation.

Source: Ezzy (2002, p. xii).

Comment: Ezzy acknowledged that qualitative research is about describing ‘the social processes that make life meaningful’. This definition emphasises the socially situated position of the researcher in relation to the people, places or roles that are being studied. Ezzy regarded the practice of qualitative research as participatory, subjective, and concerned with understanding the experiences of ‘others’ in their own terms. This participatory understanding also involves a writing strategy that recognises the contextual nature of qualitative materials.

Table 3.3. Some definitions of qualitative research as socially-situated inquiry.

suggests that there are many types of qualitative research which are not organised into a unified field of inquiry.⁴

In Table 3.1, qualitative research is defined as any research that does not use quantitative methods.⁵ Hakim argued that qualitative research includes any research that does not produce results that are entirely quantitative, although she also recognised a technical meaning of the term. Strauss and Corbin regarded qualitative research as any research that provides data that cannot be obtained using statistical or other quantitative methods. Schwandt suggested that qualitative research is the field of academic inquiry defined by its opposition to social science research based on surveys and questionnaires. Therefore, qualitative research investigates human lives, experiences, behaviour and feelings. It also concerns the operation and interactions of organisations, societies, cultures and nations. For Denzin and Lincoln, qualitative research investigates phenomena that are not measured in terms of quantity, intensity or frequency – if they are measured at all. Strauss and Corbin argued that qualitative research may include some quantitative sources of data, but that these are analysed using qualitative methods. Some of the most significant differences between qualitative and quantitative research are listed in Tables 3.4 and 3.5.

Some definitions shown in Table 3.1 identify qualitative research with specific research methods.⁶ Finch argued that qualitative research involves field research, case study methods and ethnography. However, a wider sense of the term was identified by Nelson *et al.*; who stated that ‘qualitative research is many things at the same time’ and contains contradictory elements, multiple voices and a commitment to diverse perspectives.⁷ Dey

⁴ I. Dey, *Qualitative data analysis: a user-friendly guide for social scientists*, Routledge, London, 1993, p. 10.

⁵ For examples, see C. Hakim, *Research design: strategies and choices in the design of social research*, Routledge, London, 1987, p. 8; A. L. Strauss and J. Corbin, *Basics of qualitative research: techniques and procedures for developing grounded theory*, 2nd edn, Sage Publications, Thousand Oaks, California, 1998, pp. 10–11; Schwandt, ‘Three epistemological stances’, p. 189.

⁶ J. Finch, *Research and policy: the uses of qualitative methods in social and educational research*, Social Research and Educational Studies Series 2, The Falmer Press, London, 1986, p. 6; C. Nelson *et al.*, ‘Cultural studies: an introduction’, in L. Grossberg *et al.* (eds), *Cultural studies* (Routledge, New York, 1992, p. 4; Dey, *Qualitative data analysis*, p. 2; Denzin and Lincoln, ‘Introduction’, p. 4; J. van Maanen, ‘Reclaiming qualitative methods for organisational research: a preface’, in J. van Maanen (ed), *Qualitative methodology*, rev. edn, Sage Publications, Beverly Hills, California, 1983, p. 9; C. Glesne and A. Peshkin, *Becoming qualitative researchers: an introduction*, Longman, White Plains, New York, 1992, p. 9.

⁷ Nelson *et al.*, ‘Cultural studies’, p. 4.

QUALITATIVE RESEARCH

Assumptions

Reality is socially constructed
Primacy of subject matter
Variables are complex and interrelated
Variables are difficult to measure
Insider's point of view

Purpose

Contextualisation
Interpretation
Understanding human perspectives
Securing rich description

Approach

Develops grounded theory
Researcher as instrument
Naturalistic
Inductive
Searches for patterns
Seeks pluralism and complexity
Seeks description

Researcher qualities

Personal involvement
Partiality
Understanding of own position
Empathic understanding

QUANTITATIVE RESEARCH

Assumptions

Social facts have an objective reality
Primacy of method
Variables can be identified
Variables can be measured
Outsider's point of view

Purpose

Generalisability
Prediction
Causal explanations
Model building and testing

Approach

Begins with hypotheses and theories
Manipulation and control
Uses formal instruments
Deductive
Seeks consensus and norms
Reduces data to numerical indices
Seeks abstraction

Researcher qualities

Detachment
Impartiality
Objective portrayal
Rational understanding

Table 3.4. Some characteristics of qualitative and quantitative research.

Source: Adapted from Glesne and Peshkin, *Becoming qualitative researchers*, p. 7.

1) Uses of positivism and postpositivism

Both qualitative and quantitative traditions have been associated with positivism (the view that there is an objective reality that can be studied and understood) and with postpositivism (the view that there is an objective reality, although it cannot be fully understood, only approximated, using multiple methods). Both positivism and postpositivism emphasise the formulation and verification of hypotheses and theories. Both views are concerned with the validity and statistical analysis of data. However, qualitative research has departed from the positivist and postpositivist practice of testing hypotheses, instead developing grounded theory during research.

2) Acceptance of postmodern sensibilities

Qualitative research has rejected positivist, quantitative assumptions of objective reality in favour of poststructural and postmodern sensibilities. In contrast to quantitative research, qualitative research argues that positivist methods are simply one of many ways of telling stories about the world. Some forms of qualitative research reject positivist knowledge entirely, arguing that it silences other valid voices. Instead, these forms of research evaluate their narratives in terms of verisimilitude, emotionality, personal responsibility, an ethic of care, political praxis, multivocal texts and dialogue with subjects.

3) Capturing the individual's point of view

Qualitative research differs from quantitative research in its desire to understand the perspectives of human actors using participant observation and detailed interviewing.

In contrast, quantitative researchers use remote, inferential, standardised methods.

4) Examining the constraints of everyday life

Qualitative research differs from quantitative research in that it confronts the constraints of the everyday social world. Qualitative research seeks to embed its findings in the context of this social world and to accept the details of particular cases. In contrast, quantitative research attempts to ignore or abstract from the everyday social world. Quantitative research seeks to derive averages and probabilities based on statistically significant populations and random sampling.

5) Securing rich descriptions

Qualitative research finds rich descriptions of the social world to be valuable, because they reveal detailed understanding of complexity, process and context. In contrast, quantitative research is unconcerned with rich description because this detail hinders the derivation of generalisations and is value-laden and subjective.

Table 3.5. Some differences between qualitative and quantitative research.

Source: Adapted from Denzin and Lincoln, 'Introduction', pp. 9-10.

listed 45 research methods, shown in Table 3.6 and originally identified by Tesch, that constitute qualitative research. Denzin and Lincoln argued that, to achieve multidimensional representations of the world, qualitative researchers often use an array of methods, as I have done in my research, and those authors regard qualitative research as a diverse group of research strategies. As a result, some authors defined qualitative research as an umbrella term that covers many methods: Van Maanen argued that the term ‘qualitative research’ has no exact meaning in the social sciences but describes many techniques that explore the meanings of social phenomena; and Glesne and Peshkin regarded qualitative research as an umbrella term for different philosophical approaches to interpretative research.

The second group of definitions, shown in Table 3.2, regards qualitative research as interpretive inquiry: the interpretation of phenomena.⁸ For example, van Maanen stated that qualitative research includes ‘an array of interpretive techniques’. Glesne and Peshkin regarded qualitative research as a variety of forms of interpretive research. Nelson *et al.* stated that qualitative research involves the ‘interpretive understanding of human experience.’ For Strauss and Corbin, qualitative research is the interpretive analysis of data; and for Hakim, it concerns the meanings and interpretations of phenomena. Denzin and Lincoln defined qualitative research as ‘a set of interpretive, material practices that make the world visible’ – it is an attempt to interpret phenomena in terms of their meanings. Denzin and Lincoln also argued that qualitative research is concerned with the qualities of phenomena: their socially constructed nature and contexts; qualitative research explores the ways in which ‘social experience is created and given meaning’. These interpretive definitions of qualitative research represent the most common definitions of the field.

In this second group, some definitions treat qualitative research as the exploration of human experiences and interactions. Like the other definitions of qualitative research as interpretive inquiry, they are concerned with the meanings of phenomena rather than their frequency or quantity. Although these definitions do not emphasise interpretive

⁸ Examples mentioned in this paragraph are van Maanen, ‘Reclaiming qualitative methods’, p. 9; Glesne and Peshkin, *Becoming qualitative researchers*, p. 9; Nelson *et al.*, ‘Cultural studies’, p. 4; Strauss and Corbin, *Basics of qualitative research*, p. 11; Hakim, *Research design*, p. 26; Denzin and Lincoln, ‘Introduction’, pp. 3 and 8.

Action research	Focus group research
Case study	Grounded theory
Clinical research	Hermeneutics
Cognitive anthropology	Heuristic research
Collaborative enquiry	Holistic ethnography
Content analysis	Imaginal psychology
Conversation analysis	Intensive evaluation
Delphi study	Interpretive interactionism
Descriptive research	Interpretive human studies
Dialogical research	Life history study
Direct research	Naturalistic inquiry
Discourse analysis	Oral history
Document study	Panel research
Ecological psychology	Participant observation
Educational connoisseurship and criticism	Participative research
Educational ethnography	Phenomenography
Ethnographic content analysis	Phenomenology
Ethnography	Qualitative evaluation
Ethnography of communication	Structural ethnography
Ethnomethodology	Symbolic interactionism
Ethnoscience	Trancendental realism
Experiential psychology	Transformative research
Field study	

Table 3.6. Some different approaches within the field of qualitative research.

Source: Based on material provided in Dey, *Qualitative data analysis*, p. 2.

practice, they articulate a concern with the understanding of the human world and the production of rich descriptions of human behaviour, perceptions, motives, beliefs and feelings. Hakim defined the field as the study of individuals' accounts of their experiences, the ways in which these accounts are synthesised as conceptual frameworks, and the connections between human attitudes and behaviour; she pointed out that qualitative research is concerned with human individuals as the basic unit of analysis, but that it also attempts to identify patterns of related human attitudes and behaviours from the stories of individual people. A similar position is found in the definition by Glesne and Peshkin, for whom qualitative research is the exploration of 'the poorly understood territories of human interaction.'⁹

Several of the definitions presented in Table 3.2 identify qualitative research with a particular research method. Hakim regarded qualitative research as a particular research design: the use of interviews to collect case studies. Finch also recognised that qualitative research can be equated with the collection of case studies; yet this is a limited definition of the field and it contrasts with other definitions in which qualitative research is regarded as the use of an array of different methods. A broader definition of the latter type was provided by Denzin and Lincoln, who argued that qualitative research is the study of phenomena in their natural settings to produce representations such as field notes, photographs, and recordings; for these authors, qualitative research is the collection and use of many empirical materials including case studies, artefacts and texts, and it often involves the use of more than one source of information. Therefore, these definitions reveal that qualitative research encompasses both general approaches and particular methods.¹⁰

The third group of definitions, shown in Table 3.3, considers qualitative research to be socially-situated inquiry; these definitions are significantly different to those shown in Tables 3.1 and 3.2. Ward-Schofield argued that qualitative research produces an original cultural text; and Bouma stressed the need to understand 'others' in their own terms through qualitative research. Ezzy suggested that qualitative research is about participating in the lives of 'others', while Denzin and Lincoln defined qualitative

⁹ Hakim, *Research design*, p. 26; Glesne and Peshkin, *Becoming qualitative researchers*, p. 173.

¹⁰ Finch, *Research and policy*, p. 6; Hakim, *Research design*, p. 8; van Maanen, 'Reclaiming qualitative methods'; Nelson *et al.*, 'Cultural studies'; Denzin and Lincoln, 'Introduction', pp. 3-4.

research as ‘a situated activity that locates the observer in the world.’¹¹ This represents a distinctive view of the position of the researcher. In this definition, qualitative research is the act of locating inquiry within the context of representations of reality. Denzin and Lincoln further stated that ‘qualitative researchers study things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them.’ Qualitative research, consequently, is a reflexive process in which the values and attitudes of the researcher must be examined. This view is similar to the narrative approach of Cronon, described in Section 2.2, in which the position of the narrator is crucial in the production of environmental histories.

The definitions of environmental history, by Cronon, and of qualitative research, by Denzin and Lincoln, then, share similar philosophical bases. Denzin and Lincoln’s definitions of qualitative research are used in my research; their approach is also appropriate because it allows for the critical use of many sources of data. Denzin and Lincoln stated:

Qualitative research involves the studied use and collection of a variety of empirical materials – case study; personal experience; introspection; life story; interview; artefacts; cultural texts and productions; observational, historical, interactional, and visual texts – that describe routine and problematic moments and meanings in individuals’ lives. Accordingly, qualitative researchers employ a wide range of interconnected interpretive practices, hoping always to get a better understanding of the subject matter at hand. It is understood, however, that each practice makes the world visible in a different way. Hence there is frequently a commitment to using more than one interpretive practice in any study.¹²

The use of multiple sources was especially helpful in my research because of the relative scarcity of historical records about the industries operating in the Great Barrier Reef before 1920, the paucity of data about some industries – such as coral mining – in the surviving documentary records, the large geographical area of the ecosystem, and the issues of subjectivity and bias that occur in perceptions of environmental changes – particularly in oral history sources.

¹¹ J. Ward-Schofield, ‘Increasing the generalisability of qualitative research’, in M. Hammersley (ed), *Social research: philosophy, politics and practice*, Open University, Milton Keynes, 1993, pp. 200-225; G. D. Bouma, *The research process*, 3rd edn, Oxford University Press, Melbourne, 1996; Ezzy, *Qualitative analysis*, p. xii; Denzin and Lincoln, ‘Introduction’, p. 3; Cronon, ‘A place for stories’.

¹² Denzin and Lincoln, ‘Introduction’, pp. 3-4.

Analysis of Tables 3.1-3.3, therefore, reveals a variety of definitions of qualitative research. Qualitative research is variously defined as a distinct field of academic inquiry, an umbrella term referring to many research techniques, any research that is not quantitative, interpretive inquiry, the exploration of human experiences and interactions, the particular method of interviewing to collect case studies, the specific use of many methods to study phenomena in their natural settings by collecting and using empirical materials, and a situated activity that locates the researcher in the world. This research uses the definitions provided by Denzin and Lincoln, which regard qualitative research as a distinct field of interpretive inquiry, as the use of many methods to produce representations of the world, and as the activity of a socially-situated researcher.¹³ This approach is consistent with the approach of Cronon towards environmental history and it embraces the use of many sources and the production of ethical and political representations. The positions of both narrator and researcher, therefore, are critical in the production of environmental history.

Denzin and Lincoln's approach treats qualitative research as a process; a representation of that process is shown in Table 3.7. Such a view is shared by Glesne and Peshkin, who stated that 'qualitative research is evolutionary, with a problem statement, a design, interview questions and interpretations developing and changing along the way.'¹⁴ Denzin and Lincoln argued that qualitative research comprises five phases: the researcher, theoretical paradigms and perspectives, research strategies, methods of collection and analysis of empirical materials, and the politics of representation. Their view of the research process considers the biography of the researcher, who has a particular standpoint. In addition, Denzin and Lincoln stated that the researcher 'enters the research process from inside an interpretive community. This community has its own historical research traditions, which constitute a distinct point of view.' Yet that interpretive community may include both qualitative and quantitative traditions; Dey stated that 'it is more useful to define qualitative data in ways which encourage partnership rather than divorce between different research methods [...]. Measurement at all levels embraces both a qualitative and a quantitative aspect.'¹⁵

¹³ Denzin and Lincoln, *Handbook*; Denzin and Lincoln, 'Introduction'.

¹⁴ Denzin and Lincoln, 'Introduction', p. 20; Glesne and Peshkin, *Becoming qualitative researchers*, p. 6.

¹⁵ Denzin and Lincoln, 'Introduction', p. 18; Dey, *Qualitative data analysis*, p. 28.

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Table 3.7. The process of qualitative research.

Source: Denzin and Lincoln, ‘Introduction’, p. 20.

Socially-situated inquiry is crucial because of the variety of possible theoretical perspectives and methodological approaches within qualitative research. Some of the different theoretical perspectives are shown in Table 3.7, including positivism, postpositivism, constructivism, feminism, critical theory and cultural studies. Various methodological approaches such as ethnography and participant observation are also listed in Table 3.7. This diversity presents the danger of the researcher adopting a position – especially a positivist or postpositivist position – by default, since particular positions are influential in institutions. Yet, as Denzin and Lincoln have argued, it is no longer possible to make objective observations but rather ‘observations socially situated in the worlds of – and between – the observer and the observed.’¹⁶ Therefore, sensitivity must be shown to the construction of ‘otherness’ in the research process. Contemporary research involves engagement with the ethics and politics of research, the protection of empirical materials, political praxis and an ethic of care for subjects. These engagements are processes in themselves. Finally, the act of writing research findings is also a process of interpretation, representation and evaluation, and itself forms an integral part of the research process, as Richardson has acknowledged.¹⁷

Nelson *et al.* stated that qualitative research ‘is inherently political and shaped by multiple ethical and political positions’, and I have considered the ethics and politics of my research during the research process.¹⁸ My research differed from many other qualitative research studies because its subject was not a social group but an environment: the Great Barrier Reef. That environment forms the ‘other’ which has been encountered – through the representations found in documentary and visual sources and the recollections of oral history informants – in my research; such representations also constitute ‘others’ in relation to the researcher, and my conceptions of those diverse ‘others’ have been examined throughout the research process, as Stebbins advocated.¹⁹ Formal ethics approval for my research was granted by the Human Ethics Sub-Committee of James Cook University (reference H1428).

¹⁶ Denzin and Lincoln, ‘Introduction’, p. 19.

¹⁷ L. Richardson, *Writing strategies: reaching diverse audiences*, Qualitative Research Methods, Vol. 21, Sage Publications, Newbury Park, California 1990, p. 49.

¹⁸ Nelson *et al.*, ‘Cultural studies’, p. 4.

¹⁹ R. A. Stebbins, *Exploratory research in the social sciences*, Qualitative Research Methods Series, Vol. 48, Sage Publications, Thousand Oaks, California, 2001.

Some studies of changes in the Great Barrier Reef, such as the accounts of the Crown of Thorns Starfish (COTS) by Endean, and of coral bleaching by Hoegh-Guldberg, have approached the environmental history of the reefs from positions of environmental advocacy; those authors called for a reduction in human impacts on the Great Barrier Reef.²⁰ In contrast, other studies – including studies of sedimentation in the Great Barrier Reef lagoon by Ayling and Ayling, and by Larcombe and Woolfe – reject the possibility of large scale human degradation of the Great Barrier Reef.²¹ My research adopts neither position from the outset: it neither assumes nor denies human degradation of the Great Barrier Reef since European settlement. However, I attempted to maintain a position social inclusion in my research, aiming to tell stories about changes in the Great Barrier Reef from diverse perspectives; such a position is consistent with the use of oral history interviews. Furthermore, I attempted to privilege no one story above any other, in spite of the use of expert informants in my study. Many different accounts of changes in the Great Barrier Reef exist, which represent a range of opinions about the extent and significance of these changes, and that diversity is accommodated within my research. An inclusive position is compatible with both the approach of Cronon towards environmental history and that of Denzin and Lincoln towards qualitative research, and it allows for the documentation of some perspectives which are not found in previous environmental histories of the Great Barrier Reef.

3.3 Sources of data

As outlined above, qualitative data sources of two kinds were considered: documentary and oral history sources. Yet Ganter has stated that ‘the distinction between written and oral sources is, in any but the most pragmatic sense, an artificial one.’²² She acknowledged that written sources may contain as many inaccuracies and subjectivities as oral sources, and argued that all sources must be treated with equal caution. Ganter also suggested that some qualitative sources fall into an ambiguous category – between written and oral sources – such as the transcribed evidence of Royal Commission inquiries. Therefore, she argued, no single source of data should be privileged above any other. Despite Ganter’s insights, I have made a distinction in my research between

²⁰ Endean, *Acanthaster planci*; Hoegh-Guldberg, *Climate change*.

²¹ Ayling and Ayling, *Effect of the Daintree River flood plume*; Larcombe and Woolfe, ‘Increased sediment supply’.

²² Ganter, *Pearl-shellers of Torres Strait*, p. 12; see also the discussion on p. 13 of that book.

documentary and oral history sources, because one intended outcome of my study is an evaluation of the value of qualitative methods in environmental history research about the Great Barrier Reef. As those types of qualitative sources may vary in their value for environmental history research, they must be considered separately.

Documentary sources include European written records describing various aspects of the Great Barrier Reef for the last 150 years. The most diverse and abundant of those documents are the historical books that are held in the collections of major Australian libraries and the GBRMPA. Historical books include both fictional and nonfictional accounts of the Great Barrier Reef. Many historical leaflets – including tourist literature – also describe the Great Barrier Reef. Another significant documentary source is found in the Queensland Government reports contained in the *Queensland Parliamentary Papers* (*QPP*), *Queensland Parliamentary Debates* (*QPD*) and *Queensland Votes and Proceedings* (*QVP*); those documents are held in the major libraries of Queensland. Export statistics for the early European reef fisheries, described in Section 5.3, were obtained from the *Statistics of the Colony of Queensland* (*SCQ*) and from the *Statistics of the State of Queensland* (*SSQ*). A further documentary source is found in the records of various Queensland Government Departments; these are held in Queensland Government Departmental offices or in the Queensland State Archives (QSA) in Brisbane. Other documentary sources include local, regional and national newspapers, which contain journalistic accounts, and manuscripts. A list of the written documentary sources I have used is given in Table 3.8.

Documentary sources also include visual representations such as historical photographs, films, video-recordings, maps, posters and sketches. Such materials can convey rich impressions of past conditions of the Great Barrier Reef although the significant difficulties involved in their interpretation have been discussed by Ball and Smith, and by Wachenfeld.²³ Visual representations are held in the collections of major libraries in Australia, particularly those containing major collections of historical material such as the Mitchell Library (ML) (Sydney); the materials are often held in specialist collections of historical photographs, maps, films and video-recordings: as, for example,

²³ M. S. Ball and G. W. H. Smith, *Analysing visual data*, Qualitative Research Methods, Vol. 24, Sage Publications, Newbury Park, California, 1992; Wachenfeld, 'Report of the Historical Photographs Project'.

<i>Source</i>	<i>Period</i>	<i>Types of material</i>	<i>Locations</i>
Historical books	Pre-1960	Scientific texts Description and travel literature Fiction	National Library of Australia, Canberra Australian Museum Library, Sydney Mitchell Library, Sydney Queensland Museum Library, Brisbane John Oxley Library, Brisbane Fryer Library, St Lucia, Brisbane GBRMPA Library, Townsville Townsville City Library, Townsville James Cook University Library, Cairns Cairns City Library, Cairns
Historical leaflets	Pre-1960	Tourist leaflets Tourist brochures Information pamphlets	National Library of Australia, Canberra Mitchell Library, Sydney John Oxley Library, Brisbane GBRMPA Library, Townsville
Government reports	Pre-1970	<i>Queensland Parliamentary Papers (QPP)</i> <i>Queensland Parliamentary Debates (QPD)</i> <i>Queensland Votes and Proceedings (QVP)</i> <i>Statistics of the Colony of Queensland (SCQ)</i> <i>Statistics of the State of Queensland (SSQ)</i>	University of Queensland Library, St Lucia, Brisbane Cairns Historical Society, Cairns
Government records	Pre-1970	Records of the Queensland Department of Harbours and Marine (QDHM) Records of the Queensland Environmental Protection Agency (QEPA) Records of the Queensland Department of Aboriginal and Island Affairs (QDAIA)	Queensland State Archives, Brisbane Queensland Environmental Protection Agency, Brisbane Queensland Department of National Parks and Wildlife, Cairns
Newspapers	Pre-1960	<i>The Cairns Post</i>	<i>The Cairns Post</i> Archives, Cairns James Cook University Library, Cairns Cairns City Library, Cairns
Manuscripts	Pre-1980	Field diaries Field notes Reports Presentation notes Book manuscripts Business records Miscellaneous correspondence	Manuscript collection, National Library of Australia, Canberra

Table 3.8. Some documentary sources relating to the Great Barrier Reef.

at the GBRMPA Library in Townsville, where the Historical Photographs Project represents a special photographic collection.²⁴ Many methodological issues arise in the use of visual representations – especially in the interpretation of historical photographs – and I discuss those issues in Section 3.4. Nonetheless, some visual representations provided valuable information about the nature of historical human activities in the Great Barrier Reef region, including the photographs of coral collecting that are presented in Section 5.5. In some cases, therefore, visual representations constitute the only sources of data for particular locations or periods. A list of the visual representations used in my research is found in Table 3.9.

Oral sources comprise spoken materials, often preserved in recorded interviews and transcripts. They include a range of types of speech: from structured oral history interviews to informally collected conversations, unstructured interviews, anecdotal reports and comments.²⁵ Robertson acknowledged that, while oral sources have been regarded as the most unreliable and subjective of all qualitative sources, they also offer distinctive insights into the attitudes and motives of human actors; her view was supported by Allen and Montell, who stated that ‘orally communicated history is a valid and valuable source of historical information, as oral tradition and formal history complement one another’; Ganter, likewise, argued that written, visual and oral sources are equally useful – and equally problematic.²⁶ Oral sources offer unique opportunities to investigate human perceptions, beliefs, feelings, intentions and memories: they can explore those experiences in depth and detail. Oral evidence comprises both specially-collected, original interviews with key informants and pre-existing materials that are available for re-interrogation. Both original and pre-existing oral histories were used in my research; these sources are summarised in Table 3.10.

At the national scale, the main sources of data relating to the Great Barrier Reef are held in the collections of the following Australian institutions: the GBRMPA (Townsville), the Australian Institute of Marine Science (AIMS) (Townsville), the National Library of

²⁴ Wachenfeld, ‘Long-term trends’; Wachenfeld, ‘Report of the Historical Photographs Project’.

²⁵ B. Gillham, *The research interview*, Continuum, London, 2000.

²⁶ B. M. Robertson, *Oral history handbook*, 4th edn, Oral History Association of Australia (South Australia Branch) Inc., Adelaide, 2000; B. Allen and W. L. Montell, *From memory to history: using oral sources in local historical research*, The American Association for State and Local History, Nashville, Tennessee, 1981, p. 3; Ganter, *Pearl-shellers of Torres Strait*, pp. 11-12.

<i>Source</i>	<i>Period</i>	<i>Types of material</i>	<i>Location</i>
Historical photographs	Pre-1970	Scenic photographs Scientific photographs Aerial photographs Postcards	IMAGES1 photographic collection, National Library of Australia, Canberra Geoscape scanned aerial photographs, National Library of Australia, Canberra <i>Australian seashores</i> colour transparency collection, Isobel Bennett, National Library of Australia, Canberra Australian Museum Archives, Sydney Mitchell Library, Sydney John Oxley Library, Brisbane Historical Photographs Project, GBRMPA, Townsville Cairns Historical Society, Cairns
Historical films	Pre-1960	Scenic films Scientific films	ScreenSound Australia (National Screen and Sound Archive), Canberra State Library of New South Wales, Sydney Mitchell Library, Sydney John Oxley Library, Brisbane State Library of Queensland, Brisbane
Historical video-recordings	Pre-1960	Scenic films Scientific films	ScreenSound Australia (National Screen and Sound Archive), Canberra State Library of New South Wales, Sydney State Library of Queensland, Brisbane
Historical maps	Pre-1970	Hydrographic survey charts Tourist maps Scientific maps	Historical Maps Collection, National Library of Australia, Canberra Mitchell Library, Sydney John Oxley Library, Brisbane Maps Unit, State Library of Queensland, Brisbane Queensland State Archives, Brisbane Cairns Historical Society, Cairns
Historical posters	Pre-1980	Information posters Tourist posters	State Library of New South Wales, Sydney State Library of Queensland, Brisbane
Sketches	Pre-1980	Field sketches Sketch maps <i>Cape Moreton</i> sketch maps and sketches	Manuscript collection, National Library of Australia, Canberra Queensland State Archives, Brisbane Queensland Museum Library, Brisbane

Table 3.9. Some visual representations relating to the Great Barrier Reef.

<i>Source</i>	<i>Period</i>	<i>Types of material</i>	<i>Location</i>
Pre-existing oral histories	Pre-2000	Audio cassettes Interview transcripts Interview recording notes	Oral history Collection, National Library of Australia, Canberra Oral history Collection, School of History, James Cook University, Townsville
Original oral histories	2002-2004	Audio cassettes Interview transcripts Interview recording notes Interview schedules	Collected at various locations in Australia, and by telephone
Anecdotal comments	2002-2004	Memos Field notes	Collected at various locations in Australia, and by telephone

Table 3.10. Some oral sources relating to the Great Barrier Reef.

Australia (NLA) (Canberra), ScreenSound Australia (the National Screen and Sound Archive) (Canberra), and the Australian Museum (AM) (Sydney). These institutions contain most of the scientific literature of the Great Barrier Reef and also certain specialist oral history, photographic and film collections. The major state libraries containing sources relevant to the Great Barrier Reef include the State Library of Queensland (SLQ) (Brisbane) and the State Library of New South Wales (SLNSW) (Sydney). These hold collections of maps and historical films about the Great Barrier Reef. Historical libraries include the John Oxley Library (JOL) (Brisbane), the ML (Sydney), and the Fryer Library (FL) of the University of Queensland (UQ) (Brisbane). These libraries hold specialist historical collections including many historical books, leaflets and photographs. Other libraries include the UQ Library (Brisbane), the James Cook University (JCU) Library (Cairns and Townsville), the Cairns City Library (CCL) and the Townsville City Library (TCL).

Other than in libraries, qualitative sources are held in the offices of the Queensland Environmental Protection Agency (QEPA) (Brisbane) and in the QSA. The latter holds Queensland Government records, catalogued by provenance, after files are transferred from Departmental offices, such as the Queensland Department of Harbours and Marine (QDHM). Other, active files are held in Queensland Government Departmental offices, such as the Queensland Parks and Wildlife Service (QPWS), at several locations in Queensland. The management plans for the island National Parks of the Great Barrier Reef, for example, were obtained from the office of the QPWS in Cairns. Access to some of these records is restricted for varying time periods, and to use some files required written permission. Newspaper collections are held in various public libraries and archives of Queensland; I searched archives and microfilm copies of *The Cairns Post*, in Cairns, for data. Finally, many qualitative sources – including personal photographs – are held privately and are widely distributed. Oral history informants who can recall with accuracy the period before 1980 are scarce and widely dispersed; therefore, the availability of oral history sources for this period is critical and declining; particular strategies were required for the collection of these multiple, diverse sources of data. My methods of data collection are described in Section 3.4.

3.4 Data collection

This section contains an account of the methods I have used to collect data from documentary and oral sources. Data were collected from many qualitative sources, since the purpose of my research was to use an array of such sources to synthesise an account of environmental changes. The value of using more than one method has been articulated by Denzin and Lincoln, who stated:

No single method can grasp all of the subtle variations in ongoing human experience. Consequently, qualitative researchers deploy a wide range of interconnected research methods, always seeking better ways to make more understandable the worlds of experience they have studied.²⁷

The array of qualitative methods used in my research included some of the approaches listed in Table 3.6, such as oral history interviewing, but also some methods that were not listed by Dey, including the collection of historical photographs that contained evidence of the exploitation of coral, shells, dugongs and marine turtles.²⁸ In addition to the collection of richer data, the use of an array of methods provided a means of triangulating data and, therefore, of assessing their internal consistency.

The use of multiple methods was also intended to allow an assessment to be made of the value of different qualitative sources for reconstructing past environments. Hoggart *et al.* argued that different philosophical approaches to research require different methodologies; the collection of data belongs within a particular context in which methods are validated by their compatibility with the philosophical basis of the research.²⁹ Therefore, the use of many qualitative sources in my research is consistent with an approach that sought both to reconstruct an environmental history using qualitative sources and to evaluate those sources. Some authors, such as Brannen and McCracken, argued that qualitative research should include multiple methods, including both qualitative and quantitative techniques.³⁰ Despite the value of such a methodology, my research focused on qualitative methods, since an assessment of their potential for environmental history research was one of the intended outcomes of my study. The task

²⁷ Denzin and Lincoln, 'Introduction', p. 19.

²⁸ Dey, *Qualitative data analysis*, p. 2.

²⁹ K. Hoggart *et al.*, *Researching human geography*, Arnold, London, 2001.

³⁰ J. Brannen (ed), *Mixing methods: qualitative and quantitative research*, Avebury, Aldershot, 1992; G. McCracken, *The long interview*, Qualitative Research Methods Series, Vol. 13, Sage Publications, Newbury Park, California, 1988.

of integrating qualitative findings with the extensive scientific literature of the Great Barrier Reef goes beyond the scope of my research, although some implications of the use of qualitative methods for the management of the GBRWHA are indicated in Section 8.6.

3.4.1 Collection of documentary data

The collection of documentary data involved searching through historical books, historical leaflets, government reports and records, newspapers and manuscripts. The methods of data collection used for each type of document are described below. My documentary search procedure used several strategies in order to locate as many relevant works as possible. Initially, a list of ninety-two key words or phrases was created, which were used to search each library's electronic catalogue (see Table 3.11). In general, each search was limited to works published before 1960; this restricted the search output to manageable numbers of works, although it created the potential problem that key historical works – even nineteenth century literature – may have been published after this date. Therefore, when a relatively limited search output made it possible to do so, searches were expanded to include works published before 1970. The next stage in the search procedure involved searching the electronic catalogues using the names of key authors and organisations, in order to locate more obscure works. Some rich collections were then searched by browsing call numbers, electronically, in order to scan for similar works. Finally, the JOL index card catalogue was searched manually for texts that were not catalogued electronically.

(a) Historical books

Historical books were located in the following collections: the NLA, JOL, ML, FL, SLQ, the SLNSW, the JCU Library, the GBRMPA Library, the CCL and the TCL (Table 3.1). Several hundred historical books were identified using a combination of computer-assisted and manual search techniques. These works were then searched for data about changes in the Great Barrier Reef. The historical books consulted were divided into four main categories: records of early European explorers, scientific texts of the Great Barrier Reef, Queensland description and travel literature, and fiction. These four categories are now considered in turn.

Arlington	Innisfail
beach(es)	island(s)
beche-de-mer	Keppel
Brampton	Lady Elliot
Bundaberg	Lady Musgrave
Bunker	Lindeman
Cairns	Low
Cape Capricorn	Mackay
Cape Cleveland	Magnetic
Cape Grafton	marine
Cape Tribulation	marlin
Cape York	Michaelmas
cay(s)	Mission
coast(s)	mining
coastal	Molle
coconuts	Northumberland
cocoa-nuts	ocean
Cooktown	Orpheus
coral(s)	Palm
Coral Sea	pearl
Cumberland	pearling
Daydream	pearl-shell
dolphin(s)	plantation(s)
Double	Princess Charlotte Bay
dugong	Raine
Dunk	reef(s)
environment	resort(s)
fish	Rockhampton
fishing	sea
Fitzroy	seabirds
fringing reef(s)	Seaforth
Gladstone	shell
goat(s)	Snapper
Green	Sudbury
guano	Swain
Great Barrier Reef	tourism
Great Barrier Reef Committee	tourist
Great Keppel	Townsville
Hamilton	trepang
Haycock	trochus
Hayman	turtle(s)
Heron	Upolu
Hinchinbrook	vegetation
Holbourne	whale(s)
Hook	Whitsunday(s)
Hopevale	Yarrabah

Table 3.11. The key words used in my documentary search procedure.

(i) Records of early European explorers

The records of many early European explorers of the Queensland coast and the Great Barrier Reef were published as historical books. The records of the earliest European exploration of the Great Barrier Reef, written aboard the *Endeavour* in 1770, were published in the journals and maps of Captain James Cook and of Joseph Banks. Material contained in the journals of other explorers, including Bligh, King, Stokes, Flinders, Huxley, Wickham, Bunker, Owens and Stanley also describes the north-eastern coast of Australia. Those journals were located by searching for their authors, compilers, or editors; and also by consulting the histories of early European exploration of Australia by Gill and of shipwrecks in the Great Barrier Reef by Holthouse.³¹ Records of early European explorers were generally in edited form; in some cases, microfilm copies of the original works were consulted. However, the records of some early European explorers, such as the account of the voyage of the *Astrolabe*, were not consulted because these texts have not been published in English translations.

(ii) Scientific texts

Scientific texts used in my research included historical books dealing with the scientific description, investigation and analysis of the Great Barrier Reef. Studies by Saville-Kent, for example – including his extensive overview of the Great Barrier Reef – represent the earliest body of scientific work devoted to the Great Barrier Reef.³² Subsequently, the scientific papers and books relating to the 1928-1929 Royal Society of London expedition to Low Isles form a significant source of data.³³ Other important scientific texts included the many geological studies by authors such as Agassiz, Hedley and Hill, and the early scientific reports of the Great Barrier Reef Committee (GBRC); those documents were searched comprehensively for evidence of changes in the Great Barrier Reef, including comparisons between works relating to the same locations.³⁴

³¹ J. C. H. Gill, *The missing coast: Queensland takes shape*, The Queensland Museum, Brisbane, 1988; Holthouse, *Ships in the coral*.

³² W. Saville-Kent, *The Great Barrier Reef of Australia: its products and potentialities*, W. H. Allen, London, 1893.

³³ C. M. Yonge, *A year on the Great Barrier Reef: the story of corals and of the greatest of their creations*, Putnam, London, 1930.

³⁴ Agassiz, *Letters and recollections*; C. Hedley, ‘The natural destruction of a coral reef’, *Reports of the GBRC*, Vol. 1, 1925, pp. 1-28; D. Hill, ‘The Great Barrier Reef’, *Journal of the Geological Society of Australia*, Vol. 7, 1960, pp. 412-413; Cf. Yonge, *Year on the Great Barrier Reef*, Stephenson et al., ‘Ecological survey’.

(iii) Queensland description and travel literature

An extensive body of literature describes the landscapes, activities and development of Australia and Queensland during the colonial period. This literature also includes observations on, and recollections of, travel in the region; therefore, it offered a potentially rich source of descriptions of the condition of the Great Barrier Reef written by European explorers, tourists, journalists, and beachcombers. An example of this genre is one work by Edmund Banfield, *The confessions of a beachcomber*, describing Dunk Island and surrounding islands. Other books of a similar genre – such as *On the Barrier Reef*, by Napier, and *Destination Barrier Reef*, by Lock – include descriptions of specific locations along the Queensland coast at different times.³⁵ Therefore, these works were included in my data collection strategy; however, they were extremely numerous and their titles give little indication of their scope or content. Some general, national-scale works about description and travel in Australia contained brief observations on the Great Barrier Reef, but this category was sampled and found to reveal scarce data about the Great Barrier Reef. In my research, therefore, most attention was focused on the works about description and travel in Queensland.

(iv) Fiction

The collection of documentary data from works of historical fiction was informed by the work of Sharp, who considered the use of literary fiction by geographers and argued that the social construction of fictional texts has been less well understood than the construction of scientific texts.³⁶ She argued for more careful analysis of the content and form of fictional texts and for recognition of the distinctive voice of literary fiction in geographical studies. Sharp acknowledged the danger of misinterpreting fictional texts and stated that ‘geographers are still drawing from literature those elements that reinforce the position to be argued.’ She suggested that researchers select from fictional texts only those parts which reinforce a pre-existing interpretation. In this respect, her argument was similar to that of Cronon: that environmental history narrators can reach

³⁵ E. J. Banfield, *The confessions of a beachcomber: scenes and incidents in the career of an unprofessional beachcomber in tropical Queensland*, T. Fisher Unwin, London, 1908; E. S. Napier, *On the Barrier Reef: notes from a no-ologist's pocket-book*, Angus and Robertson, Sydney, 1928; A. C. C. Lock, *Destination Barrier Reef*, Melbourne, Georgian House, 1955.

³⁶ J. P. Sharp, ‘Towards a critical analysis of fictive geographies’, *Area*, Vol. 32, No. 3, 2000, pp. 327–334, p. 329.

the conclusion that they expect to find.³⁷ Yet contextual understanding of fictional texts is crucial if these sources are to make their distinctive contribution to geographical knowledge. Sharp's insights are valuable because they warn about the subjectivity inherent in analysis of fictional texts; for this reason, fictional accounts of the Great Barrier Reef were collected, although this material was used to exemplify general perceptions of coral reefs rather than analysed using the criteria that were applied to other historical books (Section 3.5).

In works of historical fiction – such as *Death on the Barrier Reef*, by Antill – any descriptions of coral reefs and their associated environments and species that could be precisely located within the Great Barrier Reef were collected; there were relatively few such examples.³⁸ In addition, however, pieces of descriptive text relating to unidentifiable reef locations were also collected if they represented particularly exemplary or evocative writing about the Great Barrier Reef. In other words, fictional texts were searched for material which illustrated changing cultural constructions as well as changing physical environments of the Great Barrier Reef. Fewer works of historical fiction were found than other historical books, and fewer data were taken from these works. My intention in collecting data from historical fiction was more to convey an impression of the types of writing about the Great Barrier Reef found in fictional works than to attempt a comprehensive survey of fictional writing about the reefs; the latter task lies beyond the scope of my research, although it is important to acknowledge that this potential source of data requires more extensive, literary analysis. Love has provided a useful account of the ways in which scientific accounts of the Great Barrier Reef contrast with fictional works.³⁹

(b) Historical leaflets

Historical leaflets formed a small but highly descriptive documentary source; these documents were primarily intended to promote the Great Barrier Reef to visitors: particularly tourists. Most of the historical leaflets consulted in my research were published by the Queensland Government Tourist and Intelligence Bureau (QGTIB): later the Queensland Government Tourist Bureau (QGTB). Other, more scientific,

³⁷ Cronon, 'A place for stories'.

³⁸ E. Antill, *Death on the Barrier Reef*, Hammond, London, 1952.

³⁹ Love, *Reefscape*.

leaflets were produced by the GBRC. Furthermore, the leaflets reflect the descriptions and cultural constructions of the Great Barrier Reef at the time of increasing tourist development in the area. The tourist leaflets required especially cautious use; they contain superlative descriptions of corals and marine wildlife in an attempt to attract visitors. In contrast, the information leaflets produced by the GBRC present a less emotive image and contain more systematic coverage of the reefs. Historical leaflets were collected by searching the electronic catalogues of the main libraries using the list of keywords shown in Table 3.11. That method frequently failed to distinguish between historical books and historical leaflets; in many cases the search output contained a combination of both sources.

(c) Government reports

In my research, a distinction was made between government reports (the published, annual reports of Queensland Government Departments) and government records (the unpublished correspondence and other files held in Queensland Government Departmental offices and in the QSA). The reports used as data sources included the published annual reports of several Queensland Government Departments, including the QDHM, the Queensland Department of Agriculture and Stock (QDAS), the Queensland Department of Native Affairs (QDNA) and the Agent-General for Queensland in London; materials relevant to the Great Barrier Reef were found in the annual reports of these Departments, which were published, by Department, in the *QPP* and the *QVP*. Data relevant to the Great Barrier Reef could be contained within the reports of any Department, and in any year, because diverse activities such as mining, coconut planting, dredging and tourist development were managed by different Departments. Therefore, many Departmental reports were sampled, and many reports were searched in detail, for references to the Great Barrier Reef.

The collection of data from government records, therefore, represented both a longitudinal study of the activities of individual Departments, from year to year, and a cross-sectional collection of materials across Departments for the same year. This method allowed data to be found in the years that responsibility for their collection was transferred from one Department to another. In addition to the annual reports, reports of governmental debates and proceedings (for the Queensland Government) were

published in the *QPD*, and export statistics of various products – such as tortoise-shell – were obtained from the *SCQ* and the *SSQ*. The *QPD*, however, were consulted for additional material on key activities in the Great Barrier Reef, but they were not searched exhaustively. The nature of parliamentary reporting indicated that the major events involving Queensland Government Departments would be reported, primarily, in the *QPP* (and in the *QVP*, prior to the formation of the State of Queensland in 1901) and those documents represented the most comprehensive source of data about Departmental activities. Data from all of these records, in addition, was supplemented by the unpublished government records sourced from Departmental offices and QSA (see below).

During my study period, 1860-1960, the reporting procedures of Queensland Government Departments changed significantly and the organisation of Departments altered; some, such as the QDHM and the QDNA, ceased to exist during this period. The records available in the annual reports are neither continuous nor consistent; they were intended as political, not scientific, documents. Consequently, the recording and interpretation of data found in government reports requires caution and is sometimes unsatisfactory. In particular, longitudinal data series contain many disjunctions; for example, in some years the reporting of total annual catches of green turtle by weight included both shell and shell meat combined; in other years the weights of shell alone were reported. Another example is the reporting of coconut planting, which omitted detail for the earliest plantations. These inconsistencies in the data support McLoughlin's findings that major omissions and inconsistencies occur in official dredging records.⁴⁰ Yet government records provide valuable insights into the activities of Queensland Government Departments and a source of data that, in some cases, represents the only surviving record of human activity in the Great Barrier Reef.

(d) Government records

In my research, government records comprised the majority of the archival data collected. Both public and private records were sought, as distinguished by Frankfort-Nachmais and Nachmais.⁴¹ These authors categorised four types of public records:

⁴⁰ McLoughlin, 'Environmental history'.

⁴¹ C. Frankfort-Nachmais and D. Nachmais, *Research methods in the social sciences*, 4th edn, Arnold, London, 1992, p. 305.

actuarial records, political and judicial records, government documents, and media reports; of these, actuarial records (which record demographic characteristics) and political (electoral) and judicial records were not relevant to the Great Barrier Reef. However, the records of Queensland Government Departments revealed important changes in the reef environments, and media reports also contained valuable data about changes in the reefs, so these two types of archival source were sought. Private records included diaries, autobiographies, and letters; the private records of key informants, including diaries and sketches, were sought in my research and in some cases were of considerable value in understanding changes in the Great Barrier Reef.

Archival data collection was an exploratory and intuitive process. The data used were found in the AM archives and the QSA. Elder *et al.* considered the use of archival data in research and made five main observations. First, they argued that archival data are never ideal for the research intended; the researcher is challenged to use the limited materials available as resourcefully as possible. Second, archival materials reflect the concerns of their original collectors and the social and political context of that time; they do not always fit into modern categories or reflect modern sensibilities. Third, longitudinal archives are scarce and rarely yield continuous, consistent data; cross-sectional records are far more common. Fourth, both quantitative and qualitative data are found in archival records and may require different analyses. Finally, Elder *et al.* argued that any rationale for using archival data should be based on the strengths of that data, not on any attempt to ignore or overcome their weaknesses.⁴² These observations suggested that the process of archival data collection in this research must be speculative and intuitive; the archives were searched using electronic catalogues – sampled using the key words given in Table 3.11 – and by consulting the Deputy State Archivist of the QSA.

Other insights into the use of archival sources arise from the work by McLoughlin, who assessed the use of Australian government dredging records in environmental history research; she acknowledged that major gaps exist in the records and that a significant amount of basic information is missing from them. McLoughlin concluded that an inadequate record of historical dredging has been preserved in archival sources and she

⁴² G. H. Elder *et al.*, *Working with archival data: studying lives*, Qualitative Applications in the Social Sciences No. 88, Sage Publications, Newbury Park, California, 1993, p. 11.

explored the tensions existing within archival theory and practice. She also noted the distinction between different types of government archival materials: published Departmental annual reports, detailed operational records, and correspondence files; no complete record was found in any of these types of government material.⁴³ In my research, similar difficulties arose in collecting data both from published government records and from archival government reports. In particular, many of the files expected to be preserved at the QSA – including coral licences for additional coral mining areas, whose existence was suggested by the logical sequence in which the licences were issued – were not found. In addition, files that were initially expected to be kept in the QSA – including the earliest management plans for the island National Parks of the GBRMP – were not found there, and a strategy of searching for government records in regional Departmental offices was developed in response to this problem. Some management plans, for example, were instead obtained in the Departmental offices of the QPWS, in Cairns. The cases described above suggested that many useful files are still active in regional Departmental offices, or have been lost or destroyed.

(e) Newspapers

Newspapers contain journalistic articles about many events in the history of Queensland; a selection of newspaper reports were searched for data about reported conditions and changes in the Great Barrier Reef. Since these reports contain an enormous amount of data, for many localities, over an extensive time period, the selection was limited to those locations, dates, and topics for which other sources had already indicated that useful information might be gained. For example, information about the commercial dugong fisheries was obtained from the Brisbane *Courier-Mail* and the *Sydney Morning Herald*, and evidence of coral and guano mining in the Cairns region was obtained from reports published in *The Cairns Post*. The latter was also searched using an index at the JCU library, a catalogue at the Cairns Historical Society (CHS) and *The Cairns Post* archives in Cairns. Analysis of newspaper reports revealed that popular perceptions of environmental changes – for example, the impacts of coral mining on birds at Michaelmas Cay – were highly subjective and required triangulation with other sources of data. The account of coral mining presented in Section 5.4, therefore, uses newspaper reports only where these were collaborated by other evidence.

⁴³ McLoughlin, ‘Environmental history’, pp. 209 and 216.

(f) Manuscripts

Manuscripts included collections of miscellaneous documents: papers, field notes, diaries, presentations, book manuscripts, photographs and correspondence. Several relevant manuscripts were located in the manuscript collection of the NLA, including the papers of the marine biologist, Isobel Bennett, and of the poet, Judith Wright. Those manuscripts were searched exhaustively for material, as they related explicitly to the Great Barrier Reef, and they yielded many data. For example, the papers of Isobel Bennett provided details about the creation of the boat channel at Heron Island, perceived impacts of coastal development on the condition of inshore coral reefs, and the growth of tourism in the Great Barrier Reef. However, manuscript sources were not comprehensively catalogued or indexed, and the contents of many files in these collections were not stated. The manuscript collections of other individuals – for example, the papers of Patricia Clare, Axel Poignant, Allan Missen, and Phillip Toynbee – were sampled rather than searched comprehensively, as their relevance to the Great Barrier Reef was initially unclear; a selection of documents from each file was searched and those samples yielded sparse data.

The historical books, leaflets, Queensland government reports and records, newspapers and manuscripts used in my study, assembled together, provided a broad range of textual sources for analysis; such an approach, which uses an array of qualitative sources, is consistent with the methodological guidelines advocated by Travers.⁴⁴ The use of many types of documentary sources allowed for their triangulation and revealed differences in perceptions of environmental changes between authors; some examples of those differences are evident in the narratives presented in Chapters 5-7. Moreover, the distinctive nature of each documentary source, and the need to use methods that adapt to the peculiarities of each source, have been acknowledged by Hakim; for example, newspaper reports about the impacts of commercial dugong fishing required more careful interpretation than did the Queensland Government reports about that industry (Section 7.2.1).⁴⁵ My documentary data included a subset of data obtained from visual representations, which are described below.

⁴⁴ M. Travers, *Qualitative research through case studies*, Sage Publications, London, 2001.

⁴⁵ Hakim, *Research design*.

3.4.2 *Collection of visual representations*

Visual representations, in my study, included historical photographs, films, video-recordings, maps, posters and sketches. The methods used to collect data from each type of source are discussed below. The use of paintings did not form a significant part of this research, despite comments by Nordstrom and Jackson about the value of using paintings to explore interactions between human activity and coastal change.⁴⁶ A preliminary survey of the collections of paintings held in the Queensland Art Gallery (Brisbane) and the Cairns Art Gallery (Cairns) did not reveal sources of relevance to the Great Barrier Reef; hence, an extensive search for relevant paintings was not pursued. Furthermore, historical paintings were not expected to reveal accurate, place-specific representations of particular environmental changes in the Great Barrier Reef. However, a notable exception was the work of the painter, Ray Crooke, which provided valuable data about the condition of Magnetic Island during the Second World War. Other visual sources – particularly historical photographs – showed greater potential to reveal environmental changes, although Wachenfeld has discussed the methodological difficulties that should be borne in mind when using those materials (see below).

(a) Historical photographs

Photographs are among the earliest representations of the Great Barrier Reef; they have been used specifically to record the condition of the reefs and their associated species since the work of Saville-Kent in the 1890s. The quality and abundance of historical photographs of the reefs led the GBRMPA to establish its Historical Photographs Project, which involved the collection and analysis of photographs in search of evidence of environmental changes. Indeed, Saville-Kent's photographs were intended explicitly to be used for this purpose, as Wachenfeld acknowledged.⁴⁷ However, while the Historical Photographs Project formed an extensive collection of images and drew many conclusions about the decline – and improvement – of specific coral reefs, Wachenfeld argued that comparing historical photographic images with re-photographed, modern locations is too problematic for firm conclusions to be drawn about changes in coral reefs. Furthermore, the evidence that Wachenfeld analysed suggested that different

⁴⁶ K. F. Nordstrom and N. L. Jackson, 'Using paintings for problem-solving and teaching physical geography: examples from a course in coastal management', *Journal of Geography*, Vol. 100, 2001, pp. 141-151.

⁴⁷ Wachenfeld, 'Report of the Historical Photographs Project'.

environmental changes had occurred, in different places, and that no general trend was apparent. Therefore, in my research, the collection of data from historical photographs did not take place for the purpose of re-photographing reefs, although some photographs were collected if they provided clear evidence of a human impact on the coral reefs, islands, and marine wildlife of the Great Barrier Reef. For example, historical photographs illustrated the activity of turtle-riding that is described in Section 7.3.3.

Historical photographs were consulted, initially, at the collection of the Historical Photographs Project, held by GBRMPA, in Townsville. Many other collections of photographs were searched at the major libraries; in particular, the historical photographs collection at the JOL was searched exhaustively, and approximately 2,000 images were surveyed, although some photographs were unavailable due to their use in current Native Title claims; these included most of the images of dugongs. In addition to the photographs at the JOL, other historical photograph collections were searched at the ML, the NLA and the QSA. Many of the images in these collections that were relevant to the Great Barrier Reef had already been collected in the Historical Photographs Project, although many uncollected images were also found. However, the process of searching for new images revealed inaccuracies in the identification, labelling and cataloguing of images: numerous images were identified with incorrect locational information and some photographs were identified differently in different collections. Many images lacked information about the location or date of the photograph, so could not be used in my research. Cross-verification of photograph details was carried out whenever possible, and a selection of the most valuable photographs from each collection was reproduced.

In addition to the public collections of historical photographs, private holdings were also obtained during some of the original oral history interviews. Informants were asked to provide relevant photographs of the Great Barrier Reef if they were able to do so. Some informants provided extensive, annotated collections of private photographs that were used during or after the interviews. Occasionally copies of informants' photographs were made; one informant was able to compare private photographs with published images of the same locations. Another use of historical photographs in interviews required informants to identify or discuss images, or used photographs in an attempt to trigger other memories; apart from providing a means of verification,

however, this added little to the information already supplied with some of the images, and was discontinued. Finally, while the re-photography of reefs for which historical photographs exist was not an aim of my research, the re-photographed evidence of changes at Heron Island and at Low Isles, collected by Isobel Bennett, was used in my research since it provided unambiguous evidence of significant changes; some original images of Yule Point reefs were also collected as they, too, provided clear evidence of the degradation of those reefs.

(b) Historical films and video-recordings

Historical films included the works of the earliest professional film-makers, such as Noel Monkman, to explore the Great Barrier Reef using both surface and underwater photography. The films were located in the audio-visual collections of the SLQ, the SLNSW, and at ScreenSound Australia. These collections also included video-recordings; some footage preserved in each form was consulted. Many early recordings of the Great Barrier Reef were produced by the Australian National Film Board (ANFB) and these included Monkman's underwater films of coral and associated species. Other relevant films were produced for the *Australian Diary* series, including earlier footage of tourist and industrial development in north Queensland and the resorts of the Great Barrier Reef. These were surveyed and analysed as they indicated the growth of tourist resorts, such as at Green Island, and also contained evidence of human impacts on turtle populations in the Capricorn-Bunker group. Some potentially valuable historical films were not available for study because of damage to the materials; consequently, other historical films exist that could yield valuable data if they are restored.

(c) Historical maps

Many historical maps of the Great Barrier Reef exist; these constitute the earliest surviving European records of the existence and nature of the reefs, since the exploratory voyages by Bougainville and Cook. Early European exploration and navigation depended on the development of accurate hydrographic charts; some of these are preserved in the collections of many Australian libraries and archives. In these collections, data from historical maps was located within specialist map collections. Historical maps were identified using key words taken from the list shown in Table 3.11 and the search outputs were limited to maps published before 1970. This method also

identified other maps of the Queensland coast besides hydrographic charts, including scientific maps, tourist maps, and road maps. Maps were analysed for data about particular environments in the Great Barrier Reef and they revealed the nature of previous coastal and island vegetation, types of substrate, the growth of settlements, the presence of discoloured sea water, and the locations of fringing reefs. In addition, maps were used in conjunction with other sources of data, where possible, to reveal evidence of environmental changes; for example, maps of Raine Island, Low Isles and North Reef indicated the impacts of guano mining, the destruction of the *Porites Pond*, and the blasting of an access channel through the coral reef respectively. Yet the value of historical maps was limited: many represented the reefs and coastline at different scales, with varying degrees of accuracy, using inconsistent terminology and place names.

(d) Historical posters and sketches

Historical posters included the promotional posters published by the GBRMPA and by the QGTB. These posters revealed little of the exact nature of particular reefs or reef species; however, they did represent cultural constructions of the Great Barrier Reef at particular periods in the history of the region: particularly during the period of rapid tourist expansion after 1930. Therefore, several reproductions of posters (in the form of postcards) were collected in my research; they indicate popular perceptions and attitudes towards the Great Barrier Reef. Some sketches were also collected as data during my research. These included sketches found in the manuscript collections of the NLA and in the *Sailing Directions* of the lighthouse supply vessel, the *Cape Moreton*; the latter source indicated several physical changes in coral reefs, including the blasting of access channels. Sketches also included the illustrations produced by oral history informants, including annotations made on printed maps, during qualitative interviews. One informant, for example, sketched the location and extent of the coral mining operation at Snapper Island reef. Some valuable sketch maps, identifying sections of reefs for which coral mining and coral collecting permits were issued, were found in the QSA; reproductions of several of those sketch maps appear in Sections 5.4 and 5.5.

The visual representations described above – historical photographs, films, video-recordings, maps, posters and sketches – used in conjunction with other documentary sources and with oral sources, provided a comparatively small but unique data set; the

sketch map of the coral mining operation at Snapper Island, for example, reproduced in Figure 5.10, represents evidence of an environmental change for which no other source of data was found. While visual data were difficult to assess, record and describe, they gave a rich impression of human impacts in the Great Barrier Reef, including the coral mining (Figure 5.18), coral collecting (Figures 5.20, 5.22, 5.25 and 5.26), shell collecting (Figure 5.29), access channel construction (Figures 5.30 and 5.31), coconut planting (Figure 6.8), development on islands (Figures 6.13-6.17), commercial dugong fishing (Figures 7.6 and 7.9), turtle-riding (Figures 7.19-7.22), and whaling (Figure 7.26). Visual representations also suggested the various ways in which cultural constructions of the reefs were produced – and reproduced – during the period of European settlement: as shown, for example, in Figures 5.27 and 7.18.

3.4.3 Collection of oral data

My oral data collection took three forms: re-interrogation of existing oral histories, collection of original oral histories, and recording of oral fragments from other sources. My methods of data collection for each of these forms are discussed, in turn, below.

(a) Pre-existing oral histories

Pre-existing oral histories about the Great Barrier Reef were gathered from three sources. First, the oral history recordings of the School of History, at JCU, were obtained, which consisted of 18 audio cassettes, produced in 1983, and a written summary of their main themes. That collection was originally intended to investigate COTS outbreaks in the Great Barrier Reef; however, those oral histories were re-interrogated for information about more general, historical changes in coral reefs, islands and marine wildlife species. Second, the extensive oral history collection of the NLA was searched for recordings relevant to the Great Barrier Reef. Twelve relevant recordings were identified, of which ten were available for public access; two early interviews were neither available as audio cassettes nor had been transcribed. The ten available interviews were interrogated for data about changes in the Great Barrier Reef and they revealed many perceptions of changes in the ecosystem, including many references to COTS infestations. Third, one private oral history recording was obtained, in which an individual had recorded an informal qualitative interview. That interview contained evidence of the depletion of fish populations in the Great Barrier Reef.

(b) Original oral histories

Original oral histories form a major part of my research. Initially, a list of thirty key informants was created; these individuals were contacted to introduce my research and to request an interview and access to historical photographs. An introductory letter was sent to informants, which sought assistance with my study. My informants were sent a second letter to specify the research methods and to provide more details about the project. Copies of the documentation associated with the collection of oral history evidence from my informants are provided in Appendix A. Key informants were usually contacted by telephone or by electronic mail in order to arrange the interview. Interviews generally took place at the home of the informant; occasionally the informant's workplace was a more convenient location. However, telephone interviewing was increasingly used during my research since it allowed the collection of interviews from more distant informants, permitted informants to nominate a convenient time for the interview, and provided a high-quality audio recording using a telephone microphone attachment. In contrast, the face-to-face collection of oral history interviews required considerable time to be spent travelling, caused time to be wasted if informants were no longer available at the arranged time, and was susceptible to background noise and interruptions during the interview. The use of telephone interviewing allowed some of these difficulties to be overcome effectively.

The interviews were recorded onto high-quality audio cassettes. During each interview, notes were also taken throughout in order to amplify, or clarify, comments made on the cassette. For example, when informants indicated a location on a map, or a photograph, details were added in note form. Interviews generally lasted for approximately one hour; some were shorter and others significantly longer. A method of using semi-structured interviews was adopted. This schedule was developed during three pilot interviews, which revealed that the questions needed to be more specific, more focused, and less repetitive. The process of designing the interview schedule is shown in Figure 3.1; the final interview schedule is shown in Table 3.12. Yet the interview schedule acted only as a guide and some interviews departed from this form significantly; nevertheless, this approach was considered to be an advantage of semi-structured interviewing since it allowed expert informants to dictate the direction of the interview if this seemed to be necessary. Furthermore, this approach allowed unexpected data to emerge during the

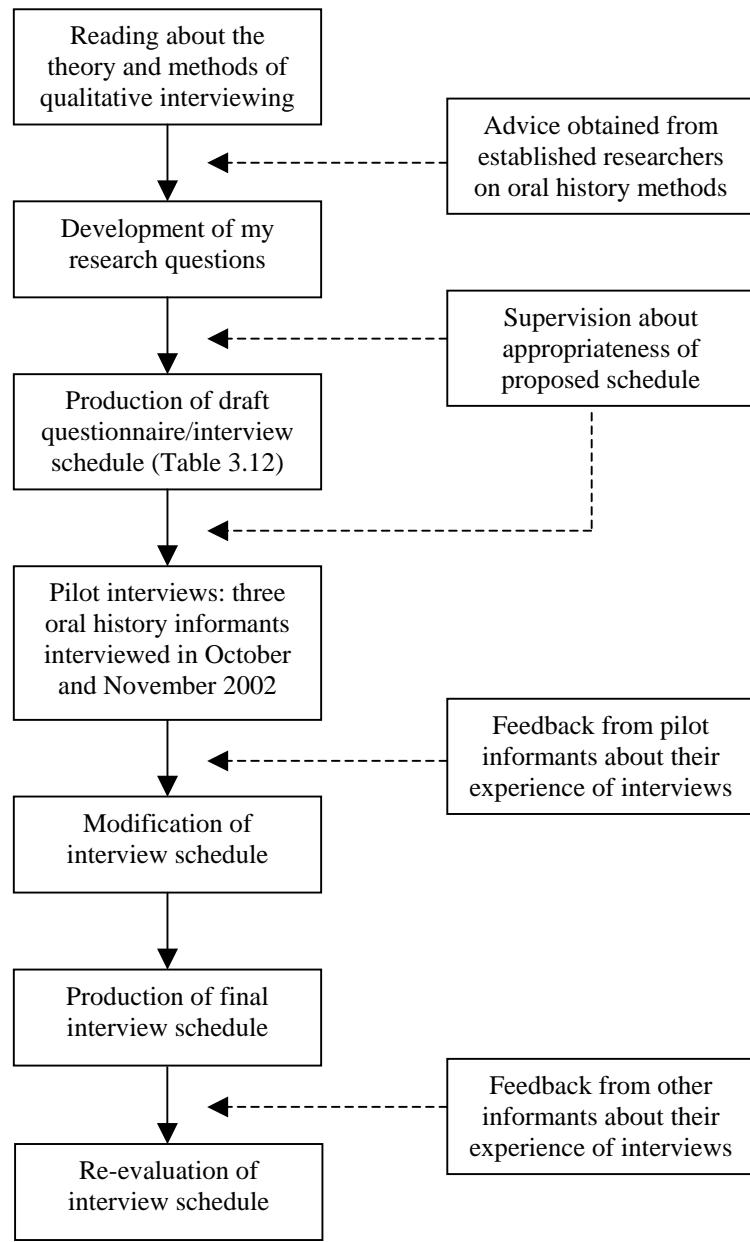


Figure 3.1. The process of designing the interview schedule.

<i>Key questions</i>	<i>Prompts (if necessary)</i>
i) Introduction to the interview	
ii) Outline of my research	
iii) Collection of informed consent	
iv) Discussion of interview length, topics, and format	
1) Would you introduce yourself and tell me something about your background and your interest in the Great Barrier Reef?	Name and preferred title Position and occupation Personal interest
2) Can you tell me how many times, and for how long, you have experienced the Great Barrier Reef?	Dates and duration Type of contact with the reefs
3) With which parts of the Great Barrier Reef are you familiar?	Names of reefs, islands or sections Types of environments
4) Would you describe your activities on the Great Barrier Reef and explain the nature of these activities?	Type of activity Contact with corals, islands, beaches and biota
5) At that time, or at those times, what was your impression of the corals?	Descriptions Evidence of change
6) What were your impressions of the islands?	Descriptions and evidence of changes
7) What were your impressions of the beaches?	Descriptions and evidence of changes
8) What were your impressions of the biota?	Descriptions and evidence of changes
9) During more recent visits to the Great Barrier Reef, have you noticed any changes in any of these aspects of the Great Barrier Reef?	Corals Islands and beaches Biota
10) Are there any particular ways in which the Great Barrier Reef has changed consistently?	Time scales Spatial scales
11) If so, what do you think has caused these changes to corals, islands, beaches or biota?	Natural and anthropogenic causes Dates and duration of influences
12) Are there any changes that you feel have been particularly detrimental to the Great Barrier Reef?	Locations of changes Dates and durations of changes
13) Can you describe your earliest impressions of coral reefs in the Great Barrier Reef region?	Descriptions Impressions
14) Can you describe your earliest impressions of islands and beaches in the Great Barrier Reef region?	Descriptions Impressions
15) Can you describe your earliest impressions of biota in the Great Barrier Reef region?	Descriptions Impressions
16) Have the corals of the Great Barrier Reef improved or declined during the period of your experience?	Specific locations Specific dates
17) Have the islands and beaches of the Great Barrier Reef improved or declined during the period of your experience?	Specific locations Specific dates
18) Have the biota of the Great Barrier Reef improved or declined during the period of your experience?	Biodiversity and populations Locations and dates
19) Are there any other changes in the Great Barrier Reef region that have not been considered here?	
20) Do you know of any other individuals who might be willing to take part in this research?	Names and positions Contact details
21) Do you know of any historical photographs that might be valuable in this research?	Locations Contact details
22) Do you have any other comments?	About the interview About the transcript About the research

Table 3.12. The final interview schedule used in my research.

course of interviews. On the other hand, the existence of the interview schedule allowed some interviews to be re-focused if they were becoming irrelevant to the investigation. At the start of every interview, each informant was asked to give written consent – or verbal consent, in the case of telephone interviews – for the interview to be conducted, recorded and transcribed. At the conclusion of every interview, each informant was asked to suggest other informants who might be able to contribute to my research.

Interviews were recorded a second time, to create preservation copies, and were then transcribed. The transcription of each interview followed the conventions described by Gillham, and in the *Oral history handbook* of the Oral History Association of Australia (South Australia Branch), compiled by Robertson.⁴⁸ In particular, most extraneous noises and redundant (filler) words were omitted, allowing the text to flow naturally and producing a less cluttered transcript for analysis, although some redundant words and sounds were transcribed in order to convey an impression of the conversational nature of the data, in line with the guidance given in the *Oral history handbook*. A copy of the transcript was supplied to each informant after the interview and many corrections and clarifications were made. Two copies of the transcripts and the preservation copies of the audio cassettes were kept securely during the progress of my research; one copy of the transcripts has been deposited at the GBRMPA Library, in Townsville, and another copy has been deposited with the JCU Library, so as to allow access to the material by other researchers. However, the public use of this oral history material has been restricted in order to protect the intellectual property and confidentiality of informants; specifically, written permission of informants and of the compiler is required before any public use of the oral history material is made.

(c) Other oral data

Other oral data included brief notes, comments, and anecdotes recorded during the course of the research. Those were collected in memo form and they served primarily to guide and focus the research process and to design the final interview schedule. These will be stored securely with the documentary data and do not form part of the original oral history collection presented to the GBRMPA, as they were not collected for the latter purpose and no consent was obtained from contributors for their public use.

⁴⁸ Gillham, *Research interview*; Robertson, *Oral history handbook*.

3.5 Data analysis

My primary method of data analysis involved the textual analysis of documentary materials and of oral history transcripts; that task was carried out using a coded system of key words that are listed in Table 3.13. Coding of texts took place in order to allow discrete data to be assigned to various analytical categories. This method represents a form of content analysis, but I did not undertake statistical analysis of the frequency of key words; instead, qualitative analysis was used to allocate pieces of textual evidence to particular topics, locations or historical periods. Hence, I compiled a database of qualitative evidence for different coral reefs, islands, and marine wildlife species, although those primary categories were supplemented by others: historical industries, human impacts, coastal locations, environmental management and perceptions of environmental changes. Those analytical categories allowed the production of discrete historical narratives that were built up into longer, more complex narratives about changes in coral reefs, islands, and marine wildlife: these in turn constitute Chapters 5-7. Further analytical distinctions were made according to the type of documentary material: historical books, leaflets, scientific reports, Queensland Government reports and records – in addition to oral history transcripts – since those materials required different types of critical analysis; separating different materials during the process of data analysis also facilitated the triangulation of materials of diverse provenance.

Visual representations, in most cases, were annotated and used to supplement documentary and oral data; consequently, little analysis of visual data took place. However, the historical maps and the sketch maps collected in my research were interpreted in the light of documentary records. For example, sketch maps of coral mining locations were matched with the archival records of the licences for those Coral Areas. Maps, sketches and photographs could also be dated if they illustrated activities for which surviving documentary records exist, or for which oral data is available. For example, a photograph depicting turtle hunting in the Fitzroy River, illustrated in Section 7.3, was identified more precisely as a result of an oral history interview with one of the turtle fishers in the photograph. Therefore, the analysis of documentary, oral and visual data allowed the cross-referencing of these sources and allowed a fuller historical narrative to be written; this justified the use of an array of qualitative methods in my research.

C. CHANGES IN CORAL REEFS

- C.a. Geomorphological changes
- C.b. Climatic and atmospheric changes
 - C.b.i. Coral bleaching
 - C.b.ii. Cyclone damage
- C.c. Biological and ecological changes
- C.d. Early reef fisheries
 - C.d.i. Bêche-de-mer
 - C.d.ii. Pearl-shell
 - C.d.iii. Trochus
 - C.d.iv. Oysters
- C.e. Coral mining
- C.f. Coral collecting
- C.g. Shell collecting
 - C.g.i. Giant clams
 - C.g.ii. Other shell species
- C.h. Other changes in coral reefs

I. CHANGES IN ISLANDS

- I.a. Early modifications to islands
- I.b. Guano and rock phosphate mining
- I.c. Changes in island morphology
- I.d. Changes in island vegetation
- I.e. Changes in island fauna
- I.f. Island development
- I.g. Other changes in islands

W. CHANGES IN MARINE WILDLIFE

- W.a. Changes in dugong populations
- W.b. Changes in turtle populations
- W.c. Changes in other species

Q. OTHER CHANGES IN THE GREAT BARRIER REEF

- Q.a. Changes in water quality
- Q.b. Changes in algae
- Q.c. Changing access to the Great Barrier Reef
- Q.d. Changing use of the Great Barrier Reef
- Q.e. Perceptions of the Great Barrier Reef

M. IMPLICATIONS FOR CONTEMPORARY MANAGEMENT

- M.a. Implications of changes in coral reefs
 - M.b. Implications of changes in islands
 - M.c. Implications of changes in marine wildlife
 - M.d. Implications of other changes
 - M.e. Implications of the use of qualitative methods
 - M.f. Implications of the use of a narrative approaches in environmental history
-

Table 3.13. The coding system used in my documentary and oral data analysis.

3.6 Data protection, data storage and ethical issues

The materials collected in my research were intended to be used for the publication of this thesis and several academic papers. In accordance with the requirements of JCU relating to the protection and storage of data, all data collected during my research were stored securely in a locked room and several back-up copies were made of all empirical materials and of any text that used these materials. The copies were also kept securely; these measures ensured the protection and confidentiality of oral history informants and of the restricted documentary sources to which I had been given access. No personal information relating to oral history informants was kept in a publicly-accessible form; nor were details about informants provided by me to any other informants unless permission had been specifically granted to do so. Documentary and visual data that were reproduced in my research were used in accordance with the data protection protocols of their source institutions: usually Australian public libraries and archives. Permission was required and obtained to copy material from the JOL, FL, ML, NLA, AM and QSA. In addition, individual written permission was required from oral history informants: to use the pre-existing oral histories held at the NLA or to conduct original interviews; in the case of telephone interviews, verbal consent was recorded instead. A copy of the form used to request permission to interview informants for original oral history interviews is reproduced in Appendix A. These measures were taken in order to ensure adequate protection, storage and integrity of data, and the protection of oral history informants and their intellectual property rights, so that my research should comply with the ethical requirements for research with human subjects.

3.7 Conclusion

This chapter has outlined the methodology used in my research; above, I have defined qualitative research and argued that the approach of Denzin and Lincoln described above, which regards qualitative research as the interpretive use of empirical materials by socially-situated researchers, is suitable for my study: their approach is consistent with a narrative approach to environmental history. In this chapter, I have outlined the sources of data available for my research and described methods of data collection, analysis, storage and protection; this has involved the use of an array of diverse qualitative materials and a variety of interpretive techniques, although textual analysis

of archival documents and of original oral history transcripts forms my dominant method. Despite some limitations, considered above, these materials nonetheless provide original evidence of environmental changes in the Great Barrier Reef. My research includes an evaluation of the value of qualitative sources in environmental history research, so the limitations of each type of material are made explicit here. These materials have been used to construct the three narratives of environmental changes that form Chapters 5-7. However, before I tell those stories, I provide a brief overview of the spread of European settlement in coastal Queensland, in Chapter 4.

4. THE SPREAD OF EUROPEAN SETTLEMENT ON THE QUEENSLAND COAST

The environmental history narratives that form the main part of my thesis (Chapters 5-7) require a historical context; the brief account of the spread of European settlement in coastal Queensland provided in this chapter serves as a general background. Beginning with the evolution of the north-eastern Australian continent since the fragmentation of the Gondwanan supercontinent, my account describes variations in sea level during the Holocene epoch, environmental transformations by Indigenous Australians, early European exploration and the establishment of the first European settlements in Queensland. European settlement spread rapidly northwards along the Great Barrier Reef coast from 1860, driven by exploration and pastoral expansion. Port development, timber-getting, mining and agriculture also occurred – with associated environmental impacts. During this period, sugar cane farming became established as the dominant coastal land use and, by around 1920, most of the economically viable land of coastal Queensland had been settled by Europeans. Substantial environmental degradation was associated with sugar cane cultivation and, subsequently, industrial and agricultural growth and urbanisation in the GBRCA have led to significant, geographically-concentrated impacts on the Great Barrier Reef.

4. THE SPREAD OF EUROPEAN SETTLEMENT ON THE QUEENSLAND COAST

4.1 Introduction

This chapter provides a brief overview of the history of European settlement on the coast of Queensland, based on secondary sources. In particular, I have used the histories by Bolton and Fitzgerald, and the account of Australian historical geography by Powell, which give additional details of the history of European settlement in Queensland.¹ This chapter situates the narratives of changes in the coral reefs, islands and marine wildlife of the Great Barrier Reef that follow within the context of the northward expansion of European settlement on the Queensland coast and the establishment of a new pattern of land use: one based on the dominant activities of pastoralism, sugar cane farming, mining and tourism. Such a historical context is required because the perceived decline of the Great Barrier Reef has been partly attributed to these terrestrial activities; as exemplified in Chapter 1, several authors have acknowledged that the Great Barrier Reef has sustained significant impacts from terrestrial sources.²

This chapter first outlines the context of the history of European settlement in coastal Queensland: the evolution of the Australasian continent, the formation of the Great Barrier Reef, Aboriginal occupation, pre-European contacts and the earliest European settlement in Australia. Next, I describe the European settlement of Queensland since the formation of its first colony, at Moreton Bay, with an emphasis on the introduction and expansion of sugar cane farming. However, other European activities – pastoralism, mining, timber-getting, bêche-de-mer harvesting and pearl-shell collecting – were also important during this period and are also mentioned. In addition to those activities, recent coastal development and the formation of coastal and marine protected areas in Queensland are considered. This brief review suggests that significant impacts upon the Great Barrier Reef have occurred during the period of European settlement, although those impacts have varied geographically and at different times.

¹ Bolton, *Spoils and spoilers*; Fitzgerald, *From the Dreaming to 1915*; Fitzgerald, *From 1915 to the early 1980s*; Powell, *Historical geography*.

² Williams, *Impacts of terrestrial run-off*, pp. 3 and 6; Williams *et al.*, ‘Current level of scientific understanding’, p. 1; Science Panel, *Report on the study of land-sourced pollutants*, p. 9.

4.2 The context of European settlement in Queensland

European settlement in Queensland followed a long and complex history of changes in the natural and cultural environment; Archer *et al.* have described many such changes in their account of Australian environmental history during the last 100 million years.³ Those changes included the evolution of the Australasian continent since the disintegration of the Gondwanaland supercontinent, the northward drift of the Australian tectonic plate, fluctuations in sea level, the formation of the Great Barrier Reef, the arrival of human societies in Australia, the development of trading relationships between Indigenous Australians and neighbouring societies, and the earliest European settlement in Australia. The chronology of these events is illustrated in Figure 4.1. Below, I discuss these changes briefly in order to provide a context for the history of European settlement in Queensland that follows. The account presented in this section also indicates the significance of the Great Barrier Reef in shaping the course of the European settlement of Queensland. Bolton began his account of the history of north Queensland by referring to the Great Barrier Reef – acknowledging its danger to navigation – and the account by Bowen and Bowen argued that the Great Barrier Reef has been of critical importance in influencing the development of the colony of Queensland, both as a hazard and as a resource.⁴

The history of the north-eastern coast of Australia began with the formation of the Australasian continent after the fragmentation of the Gondwanaland supercontinent, 200 million years ago.⁵ The Australian tectonic plate moved northwards by the process of continental drift to its present position, in which a large part of the Queensland coast lies within the tropical zone with conditions suitable for the growth of coral reefs. During the continental drift of the Australian tectonic plate, terrestrial aridity increased and considerable changes occurred in the vegetation and biota of the continent. In addition, sea level fluctuated in response to alternating glacial and interglacial climatic regimes and, during the most recent 10,000 years of the Holocene epoch, isostatic adjustments of the Australian plate caused sea level to vary in north-eastern Australia

³ Archer *et al.*, *From plesiosaurs to people*, p. 6.

⁴ See Bolton, *Spoils and spoilers*, p. 1; Bowen and Bowen, *Great Barrier Reef*, pp. 3-4, 40 and 141.

⁵ J. Lunine, *Earth: evolution of a habitable world*, Cambridge University Press, Cambridge, 1999, p. 95.

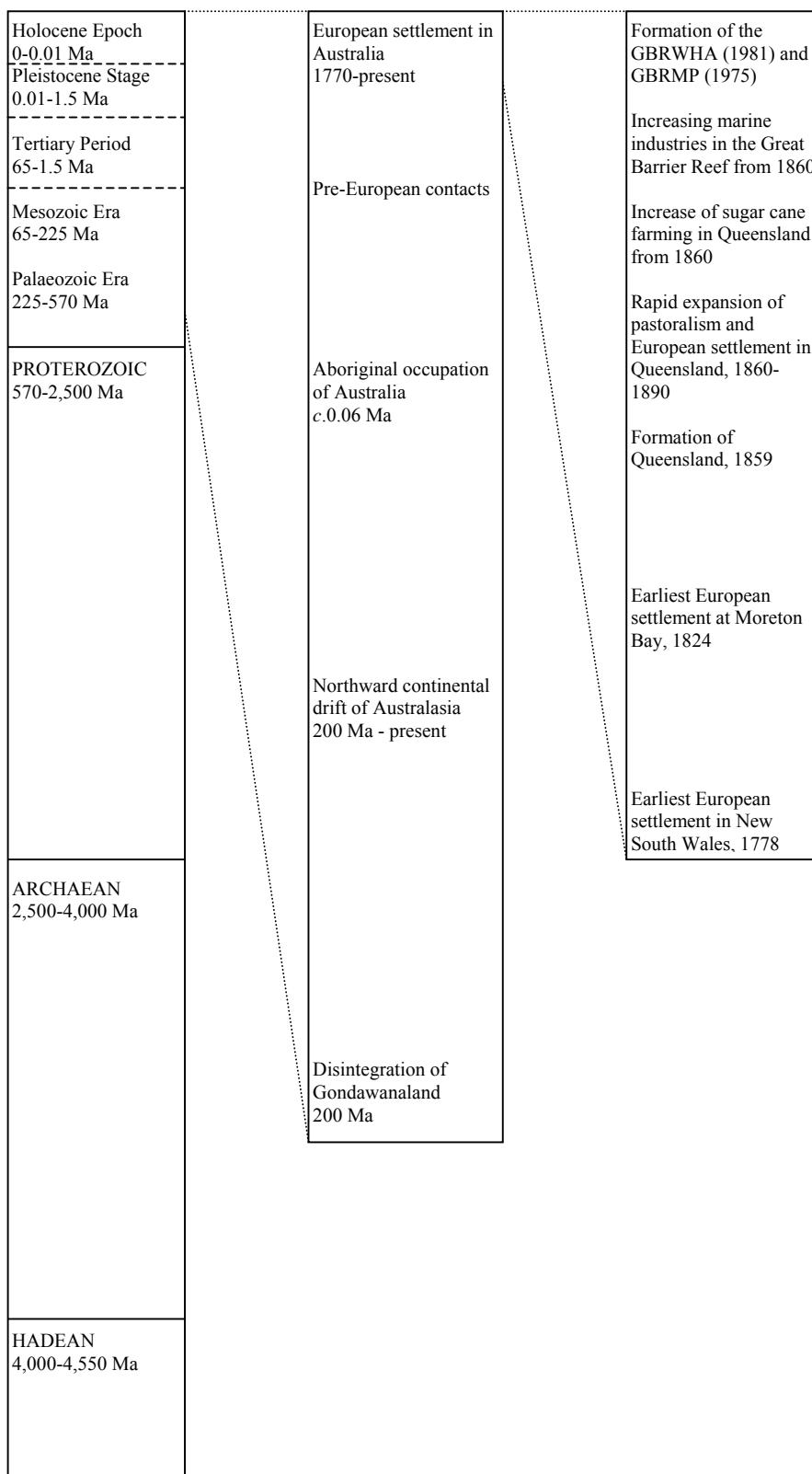


Figure 4.1. Chronology of selected environmental changes and settlement in Australia.

Source: Adapted from data provided in Lunine, *Earth, passim*.

until present sea level was reached, around 6,000 years ago.⁶ The most recent adjustment in sea level elevated fringing coral reefs in North Queensland and caused their desiccation. However, after sea level stabilised, the modern Great Barrier Reef formed on limestone foundations composed of the remains of Pleistocene reefs; hence, the Great Barrier Reef is a comparatively recent structure in geological terms.⁷

At several times during the evolution of the Australasian continent, lower sea levels existed between northern Australia and south-eastern Asia than occur at present, which allowed successive waves of human migration into Australia. Australia was populated by human societies that occupied the continent for more than 60,000 years; a complex pattern of Indigenous countries was created during this period.⁸ By the time of the earliest European settlement in Australia, the terrestrial environment had been modified by Aboriginal land management practices, including the manipulation of soils with yam sticks, the transformation of vegetation using fire, and the hunting of fauna. These impacts were considerable, although their nature and extent has been contested by several authors (see Section 2.4).⁹ Trade between Aboriginal clans was widespread and was organised along major river routes; contact between Indigenous Australian societies and other peoples, including Papuan, Cantonese and Macassan traders, was also extensive. As a result, the transformation of the Australian terrestrial environment by Indigenous societies was significant in its geographical extent and its duration.¹⁰ The Great Barrier Reef was also used extensively by Indigenous people as a source of food, tools, ornaments and trading commodities; hunting of dugongs, for example, represented an important part of Indigenous social and cultural life, as Marsh and Corkeron have acknowledged, and the hunting of marine turtles was also culturally-significant for coastal Indigenous people.¹¹

⁶ D. Hopley, 'Natural heritage attribute: geological and geomorphological aspects', in Lucas *et al.* (eds), *Outstanding universal value*, pp. 140-144, p. 140.

⁷ Bird, 'Fringing reefs near Yule Point', pp. 107 and 112-113; Hopley, *Geomorphology*, pp. 360, 362.

⁸ D. Horton (ed), *The encyclopaedia of Aboriginal Australia: Aboriginal and Torres Strait Islander history, society and culture*, Aboriginal Studies Press for the AIATSIS, Canberra, 1994.

⁹ See the accounts contained in Benson and Redpath, 'Nature of pre-European native vegetation', p. 285; Choquenot and Bowman, 'Marsupial megafauna', p. 167.

¹⁰ Fitzgerald, *From 1915 to the early 1980s*, p. 17; Hill *et al.*, 'Aborigines and fire', p. 205; Crowley and Garnett, 'Changing fire management', p. 10; Hill *et al.*, 'Rainforests, agriculture and Aboriginal fire-regimes', p. 138; Johnston, *Documentary history*, p. 101.

¹¹ H. Marsh and P. Corkeron, 'The status of the dugong in the Great Barrier Reef Marine Park', in D. Wachenfeld *et al.* (eds), *State of the GBRWHA Workshop*, pp. 234-235; see also the historical accounts provided in F. D. McCarthy, 'Aboriginal turtle hunters', *The Australian Museum Magazine*, 15 March 1955, pp. 283-286; G. James, 'Turtle hunt', *Walkabout*, March 1962, pp. 15-17.

European contact with the Australian environment began with the early exploratory voyages made by Dutch, English, Spanish, Portuguese and French mariners. Bowen and Bowen have presented evidence that Portuguese and Spanish sailors charted parts of the north-eastern coast of Australia in the years after the Portuguese settlement of Timor, in 1516, although that evidence is inconclusive because many Portuguese maps were lost in the Lisbon earthquake of 1755.¹² In 1606, part of the eastern coast of the Gulf of Carpentaria was charted by the Dutch crew of the *Duyfken*; the Spanish navigator, Luis Vaez de Torres, sailed through Torres Strait in the same year. In 1616, a Dutch vessel, the *Eendracht*, reached the northern and western coasts of Australia during voyages from Europe to the East Indies, and Dutch ships later sailed to Batavia via northern Australia. Parts of the southern coast of Australia were also charted by Dutch mariners; in 1642, Abel Tasman reached southern Tasmania. In 1622, an English ship, the *Trial*, following the same route as Tasman, sighted Australia; later, in 1688, William Dampier reached north-western Australia. The French navigator, Louis Antoine de Bougainville, sailed through the Coral Sea in 1768 and came within sight of the Great Barrier Reef.

In 1770, the British navigator, James Cook, charted the eastern coast of Australia in the *Endeavour* and claimed possession of that land – known as New Holland – for the British Crown. After the declaration of independence by the North American colonies, the British Empire faced a penal crisis that was resolved by sending convicts to Australia. The first British settlers reached Australia in 1788, when the First Fleet, commanded by Arthur Phillip, arrived at Botany Bay with a population of around 1,400 people, consisting mostly of convicts, sailors and marines. The first European settlements were established at Sydney Cove, Parramatta and Norfolk Island. Small farming was established on plots of land occupied by emancipated convicts; subsequent settlement occurred at Hobart, in Van Diemen's Land (now Tasmania), in 1804, and also at Port Arthur. The separation of Van Diemen's Land from the colony of New South Wales took place in 1825 and, from 1824-1836, four other settlements were created: Moreton Bay (now Brisbane) in 1824, Swan River (now Perth) in 1829, Port Phillip (now Melbourne) in 1835, and Adelaide in 1836. Farming, grazing and gold mining took place in the hinterlands of these settlements, stimulating the economic growth of these centres and attracting new migrants.

¹² Bowen and Bowen, *Great Barrier Reef*, pp. 14-15.

While European settlement spread along the Australian coast, inland exploration also took place. Major expeditions included the journeys made by Oxley (1817), Sturt (1828), Mitchell (1835-1836 and 1844-1845), Eyre (1840-1841), Warburton (1872-1873), Leichhardt (1844-1845), Kennedy (1848), Burke and Wills (1860-1861), Stuart (1861-1862) and Giles (1876). These expeditions facilitated the movement of European pastoralists and squatters inland, although European settlers encountered various forms of Aboriginal resistance, as several authors have narrated.¹³ Nevertheless, the period from 1850-1889 was characterised by rapid economic development in the Australian colonies, stimulated by exports of wool and discoveries of gold. Boom towns, such as Ballarat and Bendigo, prospered as gold fields attracted new European migrants. Further immigration also encouraged the growth of the major cities, especially Sydney and Melbourne, and the establishment of new ports such as those at Rockhampton and Townsville. Therefore, by the last decade of the nineteenth century, large areas of Australia had been settled by Europeans; pastoralism, agriculture and mining were expanding, and the population was approaching four million people. A period of economic depression and drought from 1890-1906 ended the period of rapid European settlement in Australia.

4.3 European settlement in Queensland

European settlement in the area that would later become Queensland began in the south-east and spread rapidly northwards and inland. This pattern is illustrated in Figure 4.2. The first settlement, known as the Moreton Bay colony, was established at Redcliffe in 1824; it was initially a convict settlement but, by 1840, free settlement had also begun in the colony. The site chosen at Redcliffe was advantageous because of the availability of safe anchorage and pastoral opportunities in its hinterland, although it lacked adequate fresh water and, in the following year, the settlement was transferred to a more

¹³ Various forms of Aboriginal resistance are described in the accounts by T. G. Birtles, 'First contact: colonial European perceptions of tropical Queensland rainforest and its people', *Journal of Historical Geography*, Vol. 23, No. 4, 1997, pp. 393-417, p. 394; G. C. Bolton, *A thousand miles away: a history of North Queensland*, Jacaranda Press, Brisbane, 1963; Loos, *Invasion and resistance*; H. Reynolds, *The other side of the frontier: Aboriginal resistance to the European invasion of Australia*, Penguin, Ringwood, Victoria, 1982; H. Reynolds, *Frontier: Aborigines, settlers and land*, Allen and Unwin, Sydney, 1987; H. Reynolds, *North of Capricorn: the untold story of Australia's North*, Allen and Unwin, Crows Nest, New South Wales, 2003, pp. vi and 11-12.

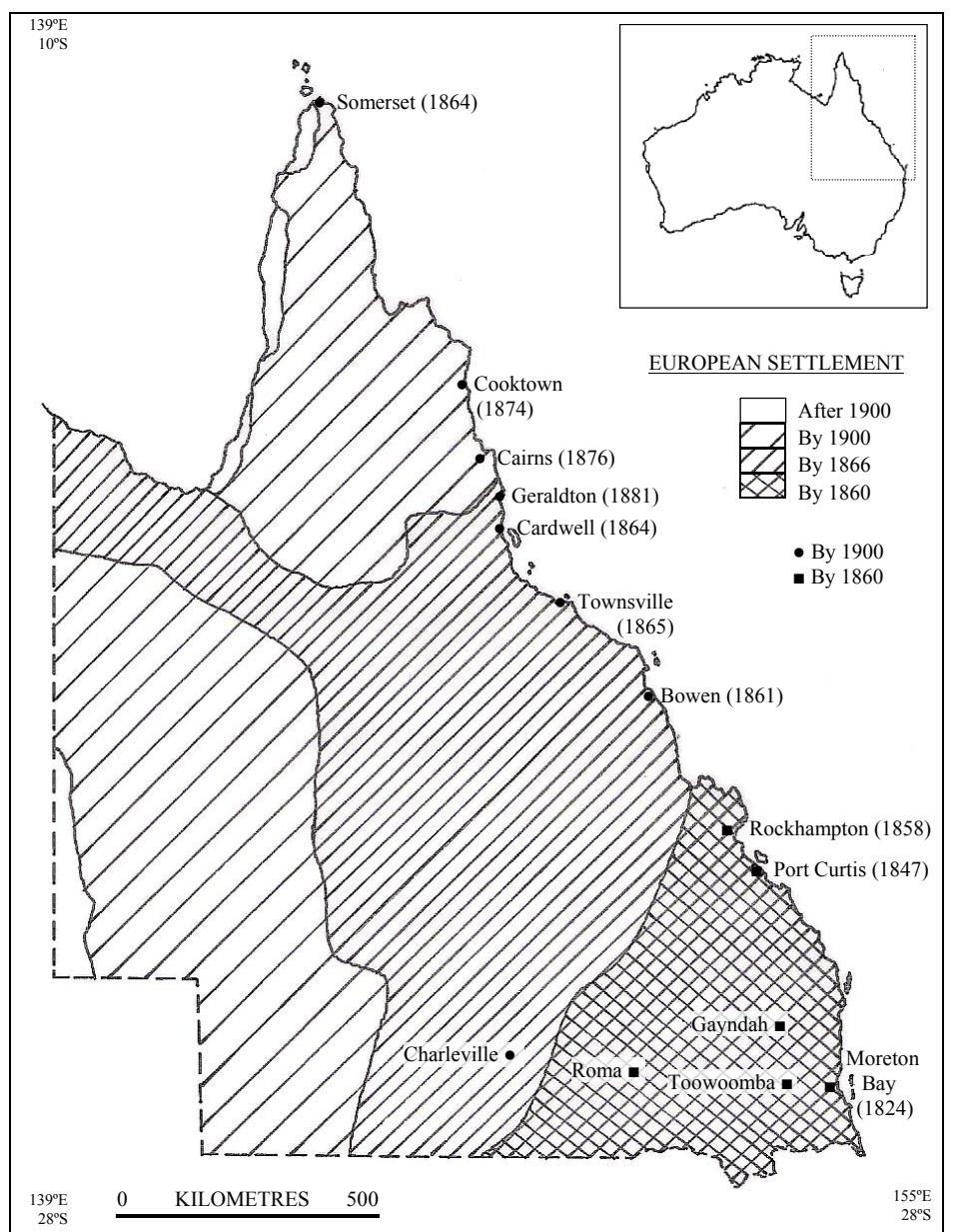


Figure 4.2. The spread of European settlement in Queensland.

Source: Compiled from data provided in Powell, *Historical geography*, p. 58; Fitzgerald, *From the Dreaming to 1915*, p. 135; and R. Ward, *Concise history of Australia*, rev. edn, UQ Press, St. Lucia, Qld., 1992, *passim*.

favourable site where modern Brisbane stands.¹⁴ As occurred elsewhere in Australia, pastoral occupation took place in the region surrounding the settlement; from 1840, the migration of pastoralists northwards in search of new grazing land was extremely rapid. As early as 1842, most of the Darling Downs had been claimed by pastoralists; soon afterwards, in 1847, a town settlement became necessary at Port Curtis (now Gladstone).¹⁵ Pastoral expansion continued and, in 1858, a third port was founded at Rockhampton. Shortly after the separation of Queensland from New South Wales, in 1859, a further coastal settlement was created at Port Denison (now Bowen).

Bolton has argued that pastoral expansion was strongly related to exploration during this period.¹⁶ Exploration, including the expeditions by Kennedy (in 1848) and by Dalrymple (in 1859), provided an indication of available resources – in particular, identifying good pastoral areas – and squatters occupied land soon after its earliest European exploration. Frontier areas were also settled by new immigrants from Europe, with the encouragement of the New South Wales government. Indeed, the movement of the pastoral frontier was so dramatic that, in 1860, Sir George Ferguson Bowen, the inaugural governor of Queensland, wrote:

There is something almost sublime in the steady, silent flow of pastoral occupation over north-eastern Australia. It resembles the rise of the tide, or some other operation of nature, rather than the work of man [*sic*].¹⁷

As a result of the rapid occupation of land, Bowen stated that ‘at the close of every year, we find that the margin of Christianity and civilisation has been pushed forward by some two hundred miles.’¹⁸

The pastoral areas opened by European exploration depended upon supplies of water, especially from the Burdekin, Fitzroy and Herbert Rivers; the location of rivers also determined the availability of fresh water for new settlements. During the European settlement of Queensland, therefore, many coastal ports were established adjacent to

¹⁴ Fitzgerald, *From the Dreaming to 1915*, p. 74.

¹⁵ Fitzgerald, *From the Dreaming to 1915*, p. 95.

¹⁶ Bolton, *Spoils and spoilers*, p. 10.

¹⁷ G. F. Bowen, *Thirty years of colonial government: selection from the despatches and letters of the Right Hon. Sir George Ferguson Bowen*, ed. S. Lane-Poole, Vol. 1, Longmans, Green and Co., London, 1889, p. 193.

¹⁸ Bowen, *Thirty years*, p. 193.

major rivers and were used by the Queensland Royal Mail Line steamers, which sailed monthly between Brisbane and London using the Inner Passage through the Great Barrier Reef, and whose operations were subsidised by the Queensland Government. On their return journeys, these ships brought new migrants to Queensland. In contrast, the development of terrestrial means of transport was slow, being hindered by the Great Dividing Range, and initially few roads and railways were constructed. Therefore, the charting of safe passages through the Great Barrier Reef was essential for the early development of Queensland. Extensive hydrographic surveying occurred during the voyages of Flinders (1802), Bunker (1803), Jeffreys (1815), King (1819), Oxley (1823), Wickham (1839 and 1845-1846), Stokes (1841), Blackwood (1843 and 1844-1845), Yule (1844-1845), and Stanley (1848).¹⁹ These surveys informed publications for mariners, such as *The Australia Directory*, which in turn enabled more reliable shipping in the Great Barrier Reef. Surveying vessels also carried naturalists aboard, including Jukes and MacGillivray aboard the *Fly* and Huxley and MacGillivray aboard the *Rattlesnake*, who documented the voyages in their journals and collected scientific data.

The development of ports encouraged the expansion of many industries in coastal Queensland. In the northern part of the colony, coastal areas were pioneered by bêche-de-mer fishers and cedar-cutters. During the second half of the nineteenth century, bêche-de-mer were harvested from coral reefs in the Great Barrier Reef, processed at small curing stations, and exported to south-eastern Asia. From 1874, timber-getters cut the forests of red cedar that were found on the Queensland coast between Cardwell and Cooktown. By 1880, merchants such as Burns, Philp and Company were trading in several tropical products, including bêche-de-mer, timber and copra.²⁰ In addition to these industries, gold mining took place at many locations, including the Palmer, Hodgkinson, Charters Towers and Ravenswood goldfields; the discovery of gold was responsible for the rapid growth of European settlements such as Cooktown and Charters Towers. However, pastoralism remained crucial to the Queensland economy throughout this period; from 1860-1900, the pastoral industry prospered as virtually all land suitable for grazing was taken up in leases; growth was also stimulated when frozen meat began to be exported to Britain during the 1870s.²¹

¹⁹ Gill, *The missing coast, passim*.

²⁰ Bolton, *Spoils and spoilers*, pp. 76 and 164.

²¹ Bolton, *Spoils and spoilers, passim*.

In addition to pastoralism, from the mid-1860s, agriculture became significant for the economic development of Queensland. Early attempts at cotton cultivation were short-lived; government subsidies for cotton farmers in the 1860s stimulated agricultural expansion, and cotton exports were successful during the period of the American Civil War, but the industry declined shortly afterwards. In contrast, sugar cane cultivation was more successful; the initial expansion of sugar cane cultivation, from 1864-1884, is shown in Figure 4.3 (a). Sugar cane was first grown in Queensland, in the mid-1860s, in the Maryborough, Brisbane and Beenleigh districts, and rapid expansion took place in the sugar industry between the late 1860s and 1884.²² By the 1880s, sugar cane farming had become prominent in the Queensland economy and contributed to the growth of the settlements at Mackay, Bundaberg, Maryborough, Geraldton (now Innisfail) and Cairns. The production of sugar cane was made more economic by the use of indentured Melanesian labourers; but, after 1884, a surplus of sugar derived from European sugar beet on the world market and the opposition, by the Queensland Government, to the recruitment and employment of Melanesian workers led to a contraction in the Queensland sugar industry in the late 1880s. After 1892, when the decision to restrict the use of indentured labourers had been reversed and the world sugar price had increased, confidence was restored in the sugar industry.

By 1900, sugar production had exceeded the demands of the colony, although an overall rapid expansion in the cultivated area of sugar cane continued to take place, as Figure 4.3 (a) shows, and exports of sugar commenced. Those increases in sugar cane acreage and sugar yields were obtained as a result of the creation of new sugar cane fields, the expansion of production on existing sugar cane land and the increasing adoption of scientific methods in sugar cane farming; Griggs has shown that the expansion of sugar cane land between 1865 and 1900 resulted in considerable environmental impacts, including the complete deforestation of land to create farmland and the cutting of timber to supply sugar mills with a source of fuel.²³ In addition to those environmental changes, the sugar industry was restructured: plantation production was replaced by the

²² For more details see P. Griggs, 'Alien agriculturalists: non-European small farmers in the Australian sugar industry, 1880-1920', in P. Ahluwalia *et al.* (eds), *White and deadly: sugar and colonialism*, Nova Science Publishers, Commack, New York, 1999, pp. 135-155, p. 137.

²³ P. Griggs, 'Improving agricultural practices: science and the Australian sugarcane grower, 1864-1915', *Agricultural History*, Vol. 78, No. 1, 2004, pp. 1-33, p. 2; P. Griggs, 'Australian scientists, sugar cane growers and the search for new gummosis-resistant and sucrose-rich varieties of sugar cane, 1890-1920', *Historical Records of Australian Science*, Vol. 14, 2003, pp. 291-311, pp. 291-292.

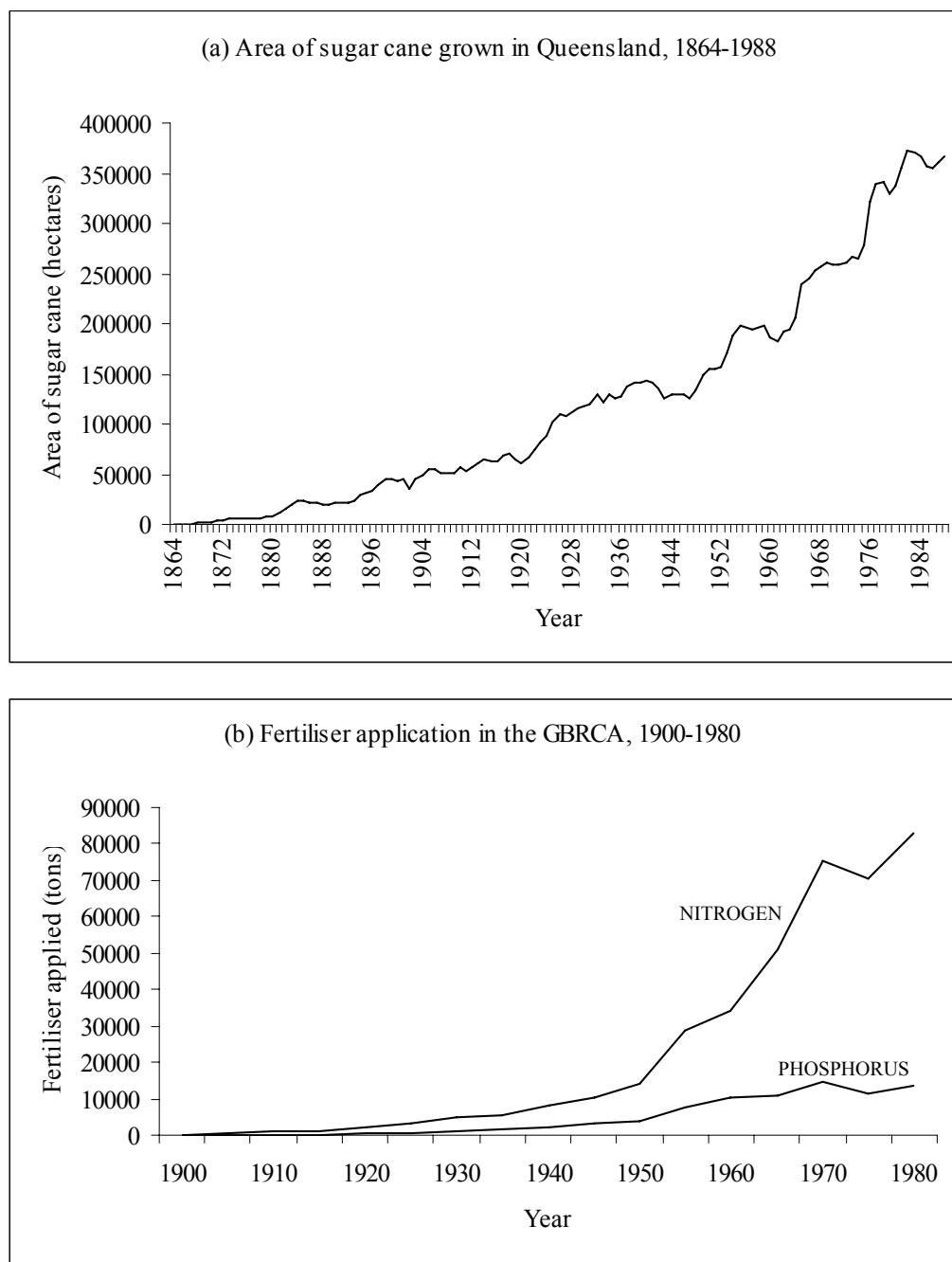


Figure 4.3. (a) Area of sugar cane grown in Queensland, 1864-1988; * (b) Fertiliser application in the GBRCA, 1900-1980.

Sources: Based on information provided in *SCQ*, 1864-1900; *SSQ*, 1901-1915; and *Australian Yearbook*, 1916-1988, compiled by P. Griggs; Pulsford, 'Historical nutrient usage', pp. 16 and 22; and Furnas, *Catchments and corals*, p. 159.

* The value for the year 1944-1945 was not published; the value for 1943-1944 has been used instead.

small cane farming system; and in 1901 the Commonwealth Government legislated to replace Melanesian workers after 1906 with white labourers only in the Queensland sugar industry.²⁴

By 1910, as Figure 4.3 (b) illustrates, the application of nitrogenous fertiliser by sugar cane farmers had commenced in the GBRCA, following the outcome of soil analyses that were conducted by the Queensland Bureau of Sugar Experimental Stations (QBSES). As a result of those experiments, the QBSES succeeding in calculating the correct fertiliser application rates for sugar cane. Keating *et al.* have demonstrated that application rates of nitrogenous fertiliser by Australian sugar cane farmers increased since around 1910, with a very substantial increase since 1950; that large increase in nitrogen use is shown in Figure 4.3 (b), which illustrates the magnitude of nitrogen application in the GBRCA, and it was accompanied by an increase in sugar cane yields.²⁵ However, these authors showed that rates of nitrogen application increased more rapidly than sugar cane yields, and that over-application of nitrogen took place in some cane-producing districts; hence, nutrient run-off to the Great Barrier Reef increased. Figure 4.3 (b) also shows the concurrent, although smaller, increase in phosphorus application in Queensland since around 1920; phosphorus represents another essential nutrient for sugar cane growth; and, without the use of artificial fertilisers, soil phosphorus levels are generally low in uncultivated or new sugar cane areas, as Wood *et al.* have acknowledged.²⁶

The soil analyses carried out by the QBSES also indicated that, in addition to nitrogenous fertiliser, the acidic soils of the northern coastal districts – including the

²⁴ Griggs, ‘Alien agriculturalists’, pp. 138-139; P. Griggs, ‘The origins and development of the small cane farming system in Queensland, 1870-1915’, *Journal of Historical Geography*, Vol. 23, No. 1, 1997, pp. 46-61, p. 46; P. Griggs, ‘Sugar plantations in Queensland, 1864-1912: origins, characteristics, distribution and decline’, *Agricultural History*, Vol. 74, No. 3, 2000, pp. 1-25, p. 1; P. Griggs, ‘Sugar demand and consumption in colonial Australia, 1788-1900’, in R. Dare (ed), *Food, power and community: essays in the history of food and drink*, Wakefield Press, Adelaide, 1999, pp. 74-90, p. 85.

²⁵ B. A. Keating *et al.*, ‘Nitrogen management in intensive agriculture: sugarcane in Australia’, in B. A. Keating and J. R. Wilson (eds), *Intensive sugarcane production: meeting the challenges beyond 2000*, CAB International, Wallingford, Oxfordshire, 1997, pp. 221-242, pp. 226-227; the increase in sugar cane yields between 1905 and 1995 has been acknowledged by A. L. Garside *et al.*, ‘The yield plateau in the Australian sugar industry: 1970-1990’, in B. A. Keating and J. R. Wilson (eds), *Intensive sugarcane production: meeting the challenges beyond 2000*, CAB International, Wallingford, Oxfordshire, 1997, pp. 103-124, p. 104.

²⁶ A. W. Wood *et al.*, ‘Opportunities for improving nutrient management in the Australian sugar industry’, in B. A. Keating and J. R. Wilson (eds), *Intensive sugarcane production: meeting the challenges beyond 2000*, CAB International, Wallingford, Oxfordshire, 1997, pp. 243-266, p. 245.

Mossman, Cairns, Innisfail and Tully districts – required agricultural lime. However, prior to 1945, the Mossman, Cairns, Innisfail, Ingham and Mackay districts had limited terrestrial sources of lime other than the inland sources at Chillagoe and Ambrose, near Mount Larcom.²⁷ In 1915, the QBSES reported that efforts were being made to produce agricultural lime by pulverising coral from the Great Barrier Reef; agricultural lime manufactured from coral had the advantages of being comparatively cheap and chemically pure. The following year, the QBSES found that interest in coral sand and coral lime was high amongst sugar cane farmers and that pulverising machines were already available on the market; farmers were advised by the QBSES to use coral lime, chemical fertilisers and green manures. By 1920, coral lime was being applied in the Mossman, Goondi, Mourilyan and South Johnstone areas at a cost of £3 per ton for coral sand and £4 per ton for burnt coral lime.²⁸ The impacts of the removal of coral from the Great Barrier Reef to produce agricultural lime are described in Section 5.4.

By 1914, the modern pattern of European occupation in coastal Queensland, and the dominant industries of grazing, sugar cane farming and mining, had been established. Closer settlement and further land clearance took place after the First World War as additional lands were allocated to returning soldiers; for example, lands at El Arish, near Tully, were occupied by discharged soldiers. Other newly-opened lands included the rainforests of the Atherton-Evelyn Tableland, which were cleared to open new grazing pastures, for maize cultivation and for dairying.²⁹ The continued expansion of sugar cane cultivation in the two subsequent decades, shown in Figure 4.3 (a), was accompanied by increasing transformations of the Queensland environment: additional land clearance, increases in fertiliser, insecticide and pesticide application rates, and ecological changes. For example, in 1935, cane toads (*Bufo marinus*) were introduced in Queensland at the recommendation of the QBSES in an effort to combat cane grub outbreaks. Furthermore, by 1939, soil erosion was acknowledged to be severe in almost every cane-producing district as farmers had increasingly cultivated sloping land; soil erosion was exacerbated by the destruction of riparian vegetation in sugar cane districts; high rates of soil erosion in the GBRCA have been reported by Crossland *et al.* for the

²⁷ AR, Qld. Dept. of Mines, *QPP*, various years.

²⁸ E. Scriven, AR, QBSES, 1914-15, *QPP*, Vol. 2, 1915-1916, p. 1175; E. Scriven, AR, QBSES, 1915-16, *QPP*, Vol. 2, 1916-1917, p. 1237; E. Scriven, AR, QBSES, 1920-21, *QPP*, Vol. 2, 1922, p. 1034.

²⁹ Birtles, ‘European interpretation’, p. 197-216.

years 1880-1935, before conservation tillage and contour farming practices were introduced.³⁰

In addition to the impacts of sugar cane farming, by 1939, other extensive alterations of the Queensland coastal environment had occurred: examples include the depletion resulting from the European marine fisheries of that period, including the commercial pearl-shell, trochus, dugong and turtle fisheries (Sections 5.3.2, 5.3.3, 7.2.1 and 7.3.2), and the transformation of some islands as a result of guano mining, the establishment of coconut plantations and the construction of tourist resorts (Sections 6.3, 6.5.1 and 6.7.2). Some of those activities, such as the turtle soup factories located at North-West and Heron Islands during the 1930s, operated intensively until localised depletion of the marine resources caused production to cease, as described in Section 7.3.2. On the adjacent coastal land, increasing use was made of insecticides and pesticides, including DDT, atrazine and diuron, which also resulted in the degradation of water quality in the Great Barrier Reef lagoon, as the evidence given in Section 1.2 indicates (Table 1.1).³¹ In addition, Meyer argued that the introduction of irrigation in the Queensland sugar cane industry, combined with insufficient drainage of farmland, contributed to waterlogging, a decline in soil fertility and enhanced nutrient and sediment run-off.³² Therefore, while the modern form of the Queensland economy became established during the period from 1860-1900, the subsequent period until 1940 involved more intensive exploitation of both terrestrial and marine resources and, by that date, the impacts of terrestrial activities on the Great Barrier Reef had probably commenced.

After 1945, the Queensland coastal environment continued to experience modification as a result of numerous activities. In particular, extensive swamp drainage to create land

³⁰ C. J. Crossland *et al.* ‘Potential impacts of sugarcane production on the marine environment’, in B. A. Keating and J. R. Wilson (eds), *Intensive sugarcane production: meeting the challenges beyond 2000*, CAB International, Wallingford, Oxfordshire, 1997, pp. 423-436, p. 427; P. Griggs, ‘Environmental change in the sugar cane producing lands of Eastern Australia, 1865-1990’, Conference paper presented at the International Congress of Historical Sciences, University of New South Wales, Sydney, 3-7 July 2005; P. Griggs, ‘Saving the land: soil erosion, scientists and the development of conservation tillage techniques in the Australian sugar industry, 1945-1995’, submitted to *Environment and History*.

³¹ Keating *et al.*, ‘Nitrogen management in intensive agriculture’, pp. 226-227; the increasing use of phosphorus, pesticides and herbicides has been discussed by Crossland *et al.*, ‘Potential impacts of sugarcane production’, p. 429.

³² W. S. Meyer, ‘The irrigation experience in Australia – lessons for the sugar industry’, in B. A. Keating and J. R. Wilson (eds), *Intensive sugarcane production: meeting the challenges beyond 2000*, CAB International, Wallingford, Oxfordshire, 1997, pp. 437-454, pp. 441 and 445.

for sugar cane cultivation, the destruction of wetland habitats, the substantial increase in soil erosion and the continued growth of coastal settlements resulted in more extensive environmental degradation in coastal Queensland.³³ The additional impacts of diverse activities on the GBRMP ecosystem have been considered by Lawrence *et al.*; those activities include the expansion of the tourist facilities on Green, Hayman and Heron Islands (Section 6.7.2), mangrove clearance for the creation of urban and industrial land in the Gladstone area, and the reclamation of coastal land in the vicinity of Cairns.³⁴ Furthermore, after 1945, expansions took place in the grazing, sugar cane, tropical fruit, tobacco and mining industries; increases in sugar cultivation, in particular, took place as wartime shortages of fertiliser and labour were overcome and as the introduction of bulk-loading facilities facilitated sugar exports. The considerable expansion of sugar cane acreage in Queensland between 1952 and 1976, illustrated in Figure 4.3 (a), occurred as a result of improved world sugar prices and growing demand from Asian customers, especially Japan, South Korea and China; however, the most suitable sugar cane lands had already been cultivated and farmers increasingly used sloping land – and, prior to 1945, without using contour farming practices, as Griggs has acknowledged – with the result that large increases in soil erosion and terrestrial run-off occurred to the inshore waters of the Great Barrier Reef.³⁵

Of the post-1945 environmental impacts in coastal Queensland, particular degradation occurred during the 1960s and 1970s, when large areas of freshwater swamps were drained for sugar cane cultivation, and when the catchments of many streams were cleared to produce additional agricultural land; these changes generated further soil erosion during that period, with the result that a substantial increase in nutrient and sediment run-off from the GBRCA occurred.³⁶ During this period, other resource exploitation was proposed in the Great Barrier Reef itself; oil exploration took place during the 1960s and many permits for oil drilling in the Great Barrier Reef were issued

³³ Many examples of environmental degradation have been described by Griggs, ‘Environmental change’.

³⁴ Lawrence *et al.*, *Great Barrier Reef, passim*.

³⁵ See P. P. Courtenay, ‘Agriculture in North Queensland’, *Australian Geographical Studies*, Vol. 16, 1978, pp. 29-42, p. 33; Griggs, ‘Environmental change’; Griggs, ‘Saving the land’.

³⁶ A. H. Arthington *et al.*, ‘Potential impacts of sugarcane production on riparian and freshwater environments’, in B. A. Keating and J. R. Wilson (eds), *Intensive sugarcane production: meeting the challenges beyond 2000*, CAB International, Wallingford, Oxfordshire, 1997, pp. 403-421, p. 404; Furnas, *Catchments and corals, passim*; Griggs, ‘Environmental change’; Meyer, ‘Irrigation experience’, p. 449.

by the Queensland Government.³⁷ However, by the late 1960s, the perceived extent of environmental exploitation in Queensland stimulated conservation, as Bowen and Bowen narrated. In particular, a proposal by the Cairns District Canegrowers Association to mine coral from Ellison Reef, near Innisfail, generated unprecedented environmental protest, which, together with public fears about the consequences of oil pollution in the Great Barrier Reef, led eventually to the formation of the GBRMP in 1975.³⁸

Therefore, the period of European settlement in Queensland represents an episode of considerable environmental change, although that episode belongs within a larger environmental history: the main environmental impacts of European settlement in Australia – and the previous environmental transformations by Indigenous Australians – that have been summarised by Archer *et al.* and that are shown in Table 4.1. Overall, in Queensland, as Powell acknowledged, European settlement was associated with increased soil erosion, as cycles of pastoral and agricultural expansion were followed by drought, leading to the degradation of large land areas; this degradation was exacerbated by forest clearance and the construction of large-scale irrigation schemes.³⁹ Such environmental changes generated increasing concern for conservation from the 1970s onwards. Significantly, since European settlement in Queensland commenced, many human impacts have been concentrated in coastal lands; evidence of the interrelations between land-use in the GBRCA and the degradation of coastal habitats has been shown in Section 1.2.⁴⁰ Since 1981, conservation in Queensland has been facilitated by the designation of the GBRWHA and, in north Queensland, of the adjacent WTWHA; as a result, monitoring of human impacts on the outstanding natural phenomena of these environments has taken place and increasing attention has been given to their management. In particular, the multiple impacts of shipping, tourism, commercial and recreational fisheries and terrestrial run-off are now recognised as threats to the environments of the Great Barrier Reef, as Lawrence *et al.* have acknowledged.⁴¹

³⁷ Fitzgerald, *From 1915 to the early 1980s*, pp. 367 and 369-370; Hopley, *Great Barrier Reef*, pp. 20-21.

³⁸ Bowen, ‘Great Barrier Reef’, pp. 245-251; Bowen and Bowen, *Great Barrier Reef*, pp. 327-328.

³⁹ Powell, *Historical geography*, pp. 159 and 324.

⁴⁰ Resource Assessment Commission, *Coastal zone inquiry: Queensland case study: coastal zone management in the Cairns area*, Resource Assessment Commission, Canberra, 1993; QEPA, *State of the environment Queensland 1999*, pp. 2-32 and 2-35.

⁴¹ Lawrence *et al.*, *Great Barrier Reef*, *passim.*; Lucas *et al.*, *Outstanding universal value*, pp. 65-66.

<i>Period</i>	<i>Environmental impacts and significant environmental events</i>
Pre-1788	Landscape transformed using fire Variable impacts in different ecosystems
1788-1850	Ecosystem modification and land degradation on pastoral properties Forest exploitation – uncontrolled and wasteful Over-exploitation of whales and seals in south-eastern waters Pollution of water supplies in coastal towns and larger settlements
1850-1914	Severe localised water pollution and soil erosion in goldfields Widespread forest clearance Introduction and spread of rabbits Many exotic species introduced with impacts on native fauna Decimation of small mammals in pastoral areas National Parks established from 1879 Major land degradation, exacerbated by droughts Increasing urban pollution
1914-1945	Land clearance and land degradation spreads and intensifies Evidence of salinisation of soil Disruption of Aboriginal burning practices affect fire-sensitive flora Continued, widespread extermination of native fauna Prickly pear infestations and use of <i>Cactoblastis</i> as a control Land degradation worsened by economic depression of the 1930s Scarcity of resources for land rehabilitation
1945-1972	Ecosystem contamination with synthetic organic chemicals (e.g., DDT) Increasing urban pollution: waste disposal, water pollution, photochemical air pollution; Hazardous waste disposal contamination Widespread wood-chipping Environmental impacts from tourism development and settlement, particularly in coastal areas Localised impacts from mining and opening of new mining areas Earliest listing of Australian World Heritage Areas

Table 4.1. Some significant environmental impacts in Australian environmental history.Source: Adapted from Archer *et al.*, *From plesiosaurs to people*, pp. 42-43.

Since 1981, very rapid expansion of the Queensland tourism industry has taken place, with the development of tourist resorts at Lizard, Green, Dunk, Magnetic and several of the Whitsunday Islands.⁴² Coastal tourist facilities, such as the developments at Port Douglas and Port Hinchinbrook, have also expanded since that date; the growth of these facilities coincides with increases in international tourism and domestic migration to Queensland since 1981. In contrast, other Queensland industries have faced crises. The tobacco industry has ceased and declining sugar prices on the world market have reduced the profitability of sugar cane farming. Other industries – including commercial fisheries – are increasingly restricted in the marine protected areas of the Queensland coast as they are believed to threaten the World Heritage status of the GBRWHA. Nonetheless, while the recent history of European activities in coastal Queensland is broadly characterised by rapid urbanisation and expansion of the tertiary sector, mining, grazing, sugar cane farming and aquaculture remain economically significant.⁴³

4.4 Conclusion

This chapter has given a brief overview of European settlement in Queensland, which followed a long period of natural and cultural changes since the formation of the Australasian continent. The first European settlers encountered an environment that had been extensively transformed by natural processes and by Indigenous land management practices. In that context, the spread of European settlement, driven by pastoral expansion, was extremely rapid after the founding of Moreton Bay in 1824; by 1860, three major coastal ports were operating and, by 1920, most of the economically viable land in Queensland had been taken up by settlers. After 1860, sugar cane farming became the dominant form of agriculture in the colony and, later, extensive plantation production methods were replaced by the small cane farming system. By 1900, significant environmental impacts had taken place in coastal Queensland, including the depletion of guano, bêche-de-mer, pearl oysters, dugongs, marine turtles, red cedar and rainforest areas, as the earliest terrestrial and marine industries became established. In the following decades, closer settlement and further land clearance also contributed to

⁴² Lawrence *et al.*, *Great Barrier Reef*, pp. 82 and 217-218.

⁴³ Bowen and Bowen, *Great Barrier Reef*, p. 385; J. M. Powell, 'A legacy of competing imperatives – environment and development in Australia since 1788', *Land Degradation and Rehabilitation*, Vol. 5, No. 2, 1994, pp. 89-106.

environmental degradation, which was compounded by the rapid expansion of tourism, commercial fisheries and mining during the second half of the twentieth century.

As many of these activities occurred in coastal Queensland, European settlement has resulted in the degradation of the adjacent Great Barrier Reef, as the studies listed in Chapter 1 indicate. The very rapid spread of European influence in Queensland, the predominantly coastal European population and the relative economic specialisation of the colony imply that environmental impacts were concentrated temporally and geographically. As a result of the dominance of grazing, sugar cane farming and mining in Queensland, those industries have produced the major impacts on the Great Barrier Reef. Furthermore, the inaccessibility of large parts of the Queensland coast – particularly in Cape York – during most of the period of European settlement means that European impacts were localised in the Cairns, Townsville, Whitsunday and Gladstone areas. Considerable impacts on the Great Barrier Reef occurred as a result of guano and coral mining, the collection of coral and shells, the introduction of exotic species such as *Lantana*, and dugong and marine turtle fishing. These and other impacts are discussed in the following three chapters, which present evidence of changes in the coral reefs, islands and marine wildlife of the Great Barrier Reef.