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Global Deserts in Perspective

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Introduction

For centuries, deserts have captured the public imagination as places of extremes. These are landscapes that might be perceived as impenetrable barriers to human occupation or instead as the domain entered into by individuals pursuing a revelatory experience. They are of course also the same terrain through which the Tigres and Euphrates rivers passed and which, when hydraulically "tamed," became the agricultural powerhouses of the Near East.

Desert societies have also been central to the anthropological imagination. The classic ethnographies of hunter-gatherer societies – of the *Ju"/Hoansi* (*!Kung*), the *Paiute* and *Shoshone*, the *Arrernte*, *Pitjantjatjara*, and *Pintubi* – all deal with desert peoples. Surprisingly, very few analyses have adopted a comparative perspective on a global scale (however, see Peterson 1979). This volume aims to bring together studies which, as a corpus, allow us to take a comparative approach to the emergence and diversity of global desert societies.

Over the last century, hunter-gatherer studies have moved from a social evolutionary perspective at the close of the nineteenth century (Spencer and Gillen 1899), to structural-functionalist or cultural ecology frameworks in the twentieth century (Gould 1969; Lee 1979; Steward 1938). The *Man the Hunter* symposium (Lee and DeVore 1968) promulgated a now popular model of hunter-gatherer society, the "generalized forager" model, which was based substantially on these desert hunter-gatherer groups. Under this model, generalized foragers shared five basic characteristics: egalitarian society; low population density; lack of territoriality; minimal food storage; and fluid band composition with changes in residential mobility used to maintain social ties and reduce intragroup conflict – though it remains to be determined whether these are characteristic of foragers in desert environments, rather than hunter-gatherers in general. The elements of this socio-economic model had been formulated in Steward's (1938) pioneering study of

Great Basin *Shoshone* and *Paiute* foragers. This model was reinvigorated during the 1970s, and at that time *!Kung* bushmen came to be seen as the quintessential hunter-gatherers. A review of social and behavioral variability in hunter-gatherers shows that there is a wide spectrum of hunter-gatherer societies if groups living in other types of habitats are included in the analysis (Kelly 1995). Over the last 20 years, hunter-gatherer research has shifted towards either behavioral ecology (Smith and Winterhalder 1992) or historical analyses of these societies (e.g., Schrire 1984; Wilmsen 1989). (For accessible interdisciplinary overviews of hunter-gatherer studies, see Lee and Daly 1999 or Panter-Brick et al. 2001.)

In putting this volume together, we felt that it was time to reframe questions about the structure and dynamics of foraging groups, using the desert environment as a frame of reference and comparison. Deserts have a special role in human evolution and adaptation. They appear to be the major terrestrial habitat that channeled early human dispersal, representing barriers at some times, corridors at others (cf. Gamble 1993). Studies of desert societies have also provided some of the most fertile ground for debates about human adaptability and how societies cope with marginal – often precarious – environmental circumstances, and about the effects of these environmental conditions on human land use, mobility, and dispersal (Kelly 1995). How do societies in marginal environments actually deal with risk in either a reactive or strategic sense? Many desert foragers in the ethnographic record appear to have responded by changing their diet-breadth and residential mobility. For others, such as in the Old World deserts of the Northern Hemisphere, the proximity of deserts to the major zones of plant and animal domestication appears to have provided a mutual ecology for change, in both the mode and relations of production. The long-term dynamics of both desert societies and the desert environment are not readily accessible to analysis using standard ethnographic or historical approaches. For this, the longer perspective provided by archaeology is necessary.

The emphasis of this volume is therefore squarely on deserts as a major world habitat, on hunter-gatherer peoples in deserts, and on the rapidly growing body of archaeological data on the deep history of these groups.

Deserts: A Modicum of Facts and Figures

Deserts are one of the world's major habitats, forming large bands of drylands along the tropics in both the Northern and Southern Hemispheres (see Mares 1999 and Middleton and Thomas 1997 for overviews of world deserts). A recent map of the extent of world deserts has been produced by the United Nations Environment Program (UNEP) (see Middleton and Thomas 1997) and is reproduced here as Figure 1.1. Deserts cover around 25,500,000 sq km, approximately 20 percent of the land area of the world (see Table 1.1). The boundaries of these drylands are neither static nor abrupt: they have changed throughout the Quaternary in response to shifts in global climate and weather systems – and will no doubt change over the next century as human-induced global warming takes effect. The defining

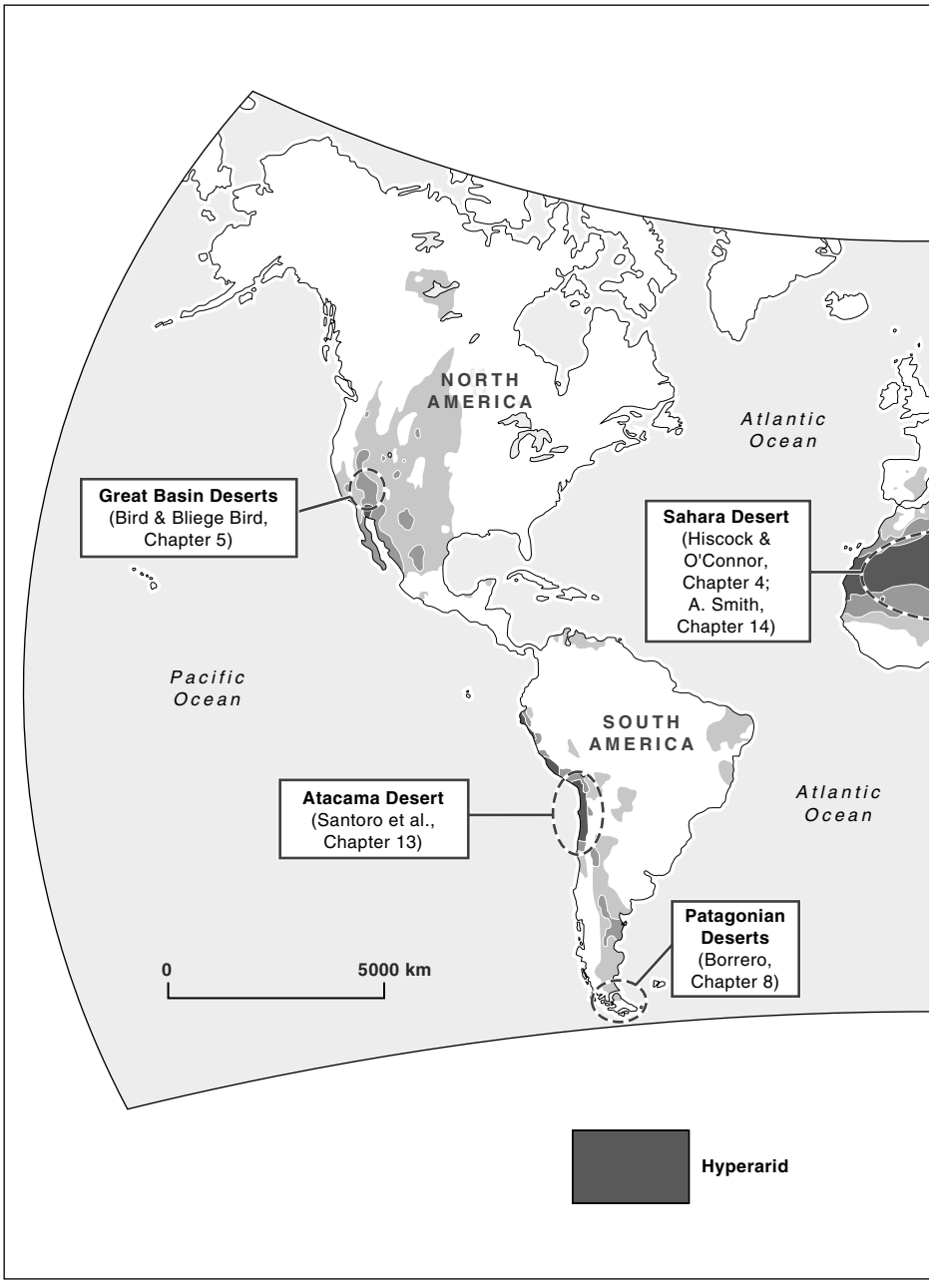
Table 1.1 Area of world deserts by region and zone. Figures are square kilometres x 1,000,000 (after Middleton and Thomas 1997: table 1.1).

Zone	*Africa*	*Asia*	*Australia*	*Europe*	*North America*	*South America*	*Total*
Arid	5.04	6.26	3.03	0.11	0.82	0.45	15.69
Hyperarid	6.72	2.77	0.00	0.00	0.31	0.26	9.78
Total	11.76	9.13	3.03	0.11	1.13	7.02	25.47

characteristic of world deserts – *aridity* – can be measured in a number of ways. The current UNEP definition is that it represents a moisture deficit under normal climatic conditions where P/PET <0.20; that is, where rainfall is less than 20 percent of potential moisture loss through evaporation. Several factors interact to determine the intensity of aridity:

- *Atmospheric stability.* Most deserts are low latitude deserts, made of two latitudinal bands along the tropics (23°N and 23°S) produced by patterns of atmospheric circulation.
- *Continentality.* Deserts are often found in the interior of continents where the reach of maritime air masses is less pronounced. This is often accentuated by topography and by cold ocean currents.
- *Topography.* High mountain ranges can form barriers to moist maritime air masses and create rain-shadow deserts, as in the case of central Asia and Patagonia.
- *Cold ocean currents.* Low sea-surface temperatures along the west coasts of continents reduce sea-surface evaporation and contribute to aridity, such as along the Namib and Atacama coasts, by reducing the effectiveness of maritime air masses.

This highlights the extreme variability in these habitats, which range from great continental deserts (such as the Sahara, Kalahari, and Australian deserts) to basin-and-range or montane deserts (such as North America's Great Basin or the *Puna* in northwestern Argentina), coastal deserts (like the Namib or Atacama), or regions where aridity is substantially increased by the rain-shadow effect of nearby mountains (such as in the central Asian deserts, or in the Patagonian deserts). There is also great variability in the intensity of aridity in world deserts. The eastern Sahara in North Africa, the Atacama in northern Chile, and the Namib in southwestern Africa all receive little or no rainfall today and are referred to as hyperarid regions. In these environments life revolves around springs or shallow groundwater seepages, stream flows from the Andes Cordillera (in the case of the Atacama), or moisture from coastal fogs (in the case of the Namib). Outside of the scattered oases or well-watered ravines, the absolute desert has few resources for a hunter-gatherer population. In contrast, the Kalahari Desert receives relatively good rainfall (250–500 mm per annum) but the deep porous Kalahari sands mean that



this is quickly lost: in effect, the Kalahari "thirstland" is an edaphic desert. The Australian deserts also receive comparatively good rainfall and like the Kalahari are well vegetated: the challenge here for people is the pronounced interannual and decadal variability in rainfall in such deserts, which are subject to a "boom and bust" cycle over decades.

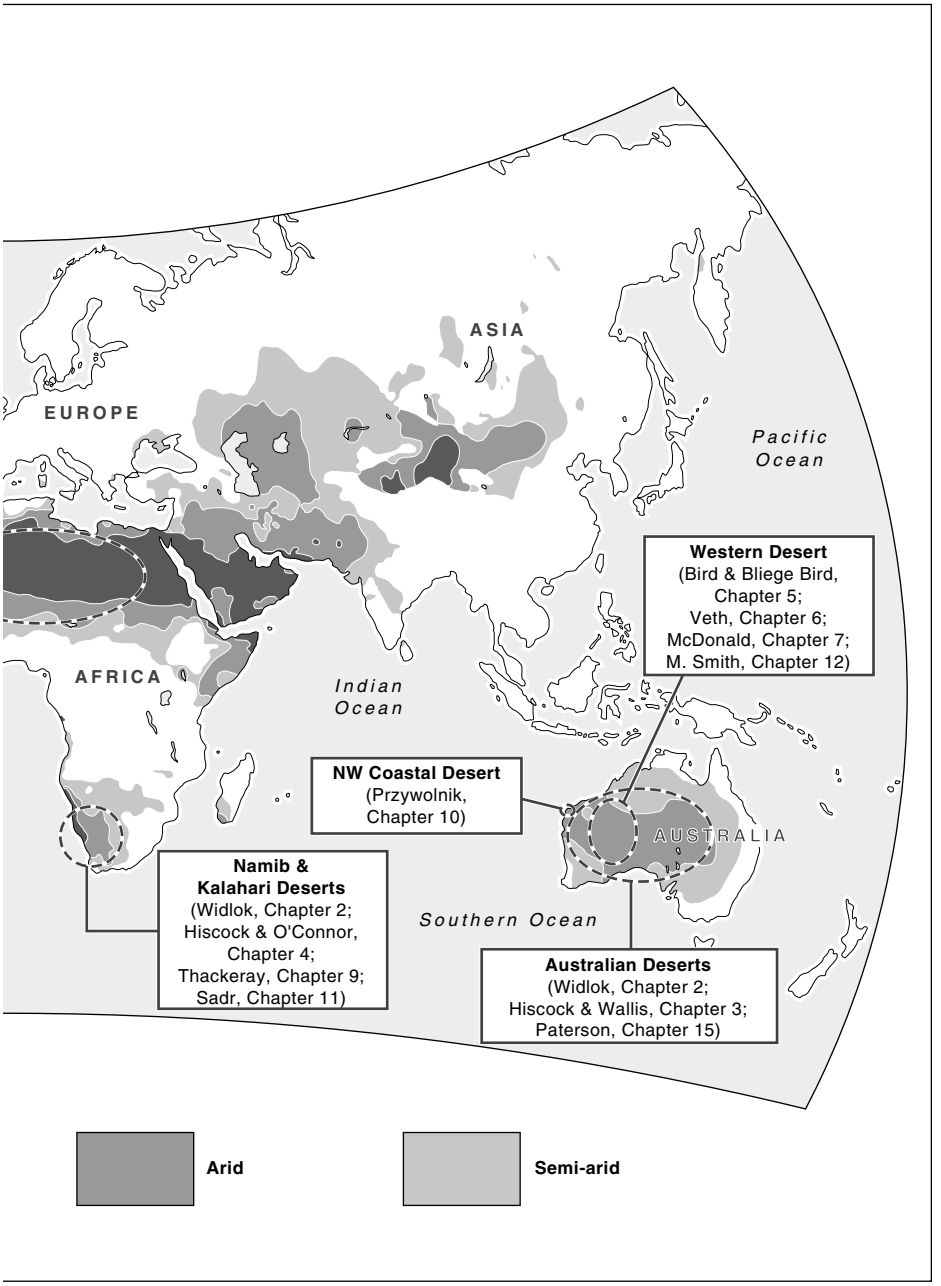


Figure 1.1 Map of world drylands based on UNEP aridity index (after Middleton and Thomas 1997: figure 6). Hyperarid = areas that have very limited and highly variable rainfall amounts, both interannually and on a monthly basis; Arid = areas that have mean annual precipitation up to about 200 mm in winter rainfall areas and 300 mm in summer rainfall areas; interannual variability in the 50–100 percent range; Semi-arid = areas with highly seasonal rainfall regimes and mean annual values up to ca. 800 mm in summer rainfall areas and ca. 500 mm in winter rainfall areas; high (25–50) percent) interannual variability.

Desert People: Some Issues

Current UNDP/UNSO statistics indicate that around 313 million people (about 13 percent of the total population) currently live in the world's arid zones, with 92 million alone residing in hyperarid deserts. These figures include significant urban populations, reliant on resources (and often water) imported from outside the zone, especially in Africa, South America, Arabia, and central Asia. It is likely therefore that prior to the rise of cities and agricultural or pastoral communities, the proportion of world population in deserts would have been significantly greater.

Deserts are difficult environments for hunter-gatherers not just because scarcity of water and other resources are limiting factors. These are environments where resources are patchy and highly variable in both time and space. Often, small parts of the wider landscape – springs, groundwater discharge zones, run-on areas – are the key to utilization of the wider region. Rainfall events create pulses of biological productivity separated by long dormant periods and these are largely unpredictable in time and space. Desert environments are characteristically subject to high interannual, decadal, and millennial variability in rainfall. In deserts, much of the ecosystem is geared towards a pattern of "pulse and reserve" (a term coined by the desert ecologist Immanual Noy Meir) or "boom and bust" that people also use and exploit for their own needs – social as well as economic. Deserts are also highly patchy environments in which nutrients and/or water are concentrated in patches within a larger, less productive landscape.

Most desert hunter-gatherers are water-tethered to some degree, but in the Australian and southern African deserts, where there are significant plant and animal resources thinly distributed throughout the desert, it is the distribution of small surface waters, seepages, wells, and springs that provides access to the desert hinterland and a means of stepping through the country; like navigating through islands on the sea (cf. Veth 1993). Hunter-gatherers in these environments have strategies which involve high residential mobility, broad-spectrum foraging, and a high degree of organizational and technological flexibility. Not all contemporary deserts, however, conform to this pattern. In the Atacama, for instance, the desert hinterland is absolute desert with no appreciable biological resources. All productivity is concentrated in the widely separated oases and ravines. Such an extreme environment favors greater investment in territoriality, "landesque" infrastructure such as semi-sedentary villages and storage facilities, and a higher level of management of wild herd animals and wild plant foods.

Generalities about the relationship between the economic/social strategies of human groups and the nature of deserts in which they live provide an insight into the historical patterns of human existence in arid lands. However, the present is not simply an iteration of the past, and explorations of ancient human colonization and settlement of deserts must deal with at least two complexities. First, past environments in which humans lived were often different, sometimes radically so, to those where people were observed in recent times. The opportunities and

constraints of those different ecosystems provided the context for early settlement strategies, and archaeological interpretations of past desert lifeways must therefore be set within a framework of the environmental history of each landscape. The second complexity involves the question of what adaptive strategies equipped people to move into deserts for the first time; what kinds of economic tactics had emerged in other landscapes that prepared human groups for survival in the variable and extreme conditions of a desert. A related question is when, and in what conditions, did the economic and social systems visible in historic desert settlement arise; and how far back in time can we recognize those forms of cultural organization?

When did people first settle these precarious environments? Archaeological evidence indicates that people have a long presence in the African deserts. Early Stone Age or Acheulian sites are reported from the Namib and Kalahari, where they are associated with ancient river courses, and in the eastern Sahara, where they are associated with artesian springs and lake deposits (e.g. at Bir Tarfawi). One of the perennial difficulties with the interpretation of such data is in determining whether this reflects exploitation of favorable patches within a desert environment or whether these areas were semi-arid savannas at that time. By the Middle Stone Age (ca. 60,000 years ago) there is good evidence for establishment of a resident hunter-gatherer population in the southern Namib Desert. The Australian deserts were widely occupied by 40,000–30,000 BP, though the nature of this occupation is still being worked out – and most researchers agree that early settlement may have been patchy.

Any discussion of the initial colonization of deserts now draws on a significant body of archaeological and biological theory about the likely pattern of dispersal into new environments and the use of patchy or mosaic environments such as deserts (for overviews, see Clobert et al. 2001; Forman 1995; Rockman and Steele 2003; Shigesada and Kawasaki 1997). In both the archaeological and biological literature, a distinction is conventionally made between the exploratory or pioneer phase of initial colonization and later establishment of a full settlement system. For instance, Beaton (1991) distinguishes between "transient explorers" and "estate settlers." Where settlement of the desert took place early, this distinction is hard to isolate using current archaeological data. Our best chance of analyzing the process of settling a new desert is in the Americas, given the relatively short prehistory of these regions. A recent review of the early settlement of North America (Haynes 2002) suggests that this two-phase model of desert colonization may be applicable there. During the Clovis period, hunters used lake and spring sites within the desert southwest (including the Mojave Desert), but wider settlement of the desert – and adaptation to desert plant resources such as seeds – did not occur until later during the early Archaic phase. Most deserts have also seen periods of enhanced rainfall, fluvial activity, groundwater discharges, and greater biological activity in the past. There is an opportunity here – provided we can get a clear definition and resolution of these changes in time and space – to look at how human societies have dealt with these periods of expanding or contracting living space and opportunities.

Outline of this Book

The chapters in this volume help shape a fresh and more comparative perspective on desert archaeology. When approached by Blackwell Publishing to commission a series of comparative chapters on this topic we quickly found that, except for pockets of research, this was largely a new area. Much of the archaeological research in deserts has simply been framed in other terms – responding either to general questions embedded in national and regional prehistories, or dominated by wider debates (e.g. the great Kalahari debate; megafaunal extinctions; the emergence of complexity in hunter-gatherer society; interpretation of lithic assemblages, etc.). Only in Australia, the world's driest continent, with more than 3,000,000 sq km of desert or drylands, has the desert become the explicit focus for research into the dispersal and adaptation of humans, and the long-term dynamics of hunter-gatherer settlement in desert environments.

The chapters in this volume have been written to introduce a new generation of students and general readers to broad issues in the archaeology of desert hunter-gatherers, complementing an earlier book, *The Archaeology of Drylands* (Barker and Gilbertson 2000), that looked at the archaeology of agricultural societies in drylands. The focus here is on hunter-gatherers. Over half of the case studies presented draw on Australian data, reflecting the level of interest in desert research there. About half the chapters look at southern African or American deserts (the Great Basin, the Atacama, and Patagonia). The major gaps in global coverage are the Middle Eastern and central Asian deserts, despite the editors' attempts to commission material on these areas.

The book is organized into three parts, which are developed further as introductory comments before the relevant chapters. In summary, the parts are:

Frameworks. This part provides wide-ranging discussion of key temporal, ethnographic, and interpretive frameworks employed in studies of desert hunter-gatherer groups from around the world.
Dynamics. This part provides a range of archaeological perspectives on the long-term dynamics of desert societies. Archaeology now provides a finer-grained historical picture of desert hunter-gatherers, showing long-terms shifts in economy and land use – but as these chapters caution, such changes are not necessarily incremental or directional.
Interactions. Clearly, there are a range of factors shaping desert societies that are not environmental. Some are social and/or political, and derive from the position of desert societies on the margins of demographically dominant populations surrounding the deserts, and their interactions with these groups.

Further themes which emerge from many of these chapters include the nature of early desert hunter-gatherer societies, the technological and organizational responses of such groups to encroaching aridity, the role of art as a mediating factor in desert occupation, the relationship between language spread and

hunter-gatherer settlement patterns, and the timing of occupation of all desert habitats and the climatic backdrop against which people's estates became established.

One of the fundamental issues addressed by this volume is the degree to which landscapes were indeed "marginal" or challenging when first explored/occupied by humans (e.g. Chapters 3 and 5). We know from regional paleoenvironmental records in Australia that climate has changed significantly since colonization by anatomically modern humans approximately 50,000 years ago and importantly that phases of aridity have followed more lacustral regimes (and vice versa). The freshwater lakes of western New South Wales which once supported abundant fish and shellfish resources are now salt lakes bordered by shifting sand fields (Johnston et al. 1998). In many regions early colonists will likely have experienced desert landscapes which were less "marginal" than their contemporary configurations. Indeed, it has been argued that early colonists of Australia were competent exploiters of the interior portions of the world's most arid continent and were not effectively tethered to the coast (cf. O'Connor and Veth 2000).

Critical to any such review is the global timing for desert occupation and what this implies about the competencies of anatomically and culturally modern humans. Do in fact humans occupy deserts early on, or only where these were semi-arid and less "marginal" landscapes? Is there evidence for occupation of all desert habitats early on? Are these occupations as early as other modern behaviors, such as the first sea crossings (from the Wallacean islands to the landmass of Greater Australia) or the earliest dated expression of art? The complexities of addressing this question are raised in Hiscock and O'Connor's discussion (Chapter 4) of the ambiguities found in many identifications of modernity, revealing that this is not merely an issue that can be resolved by substantive investigations of the timing of desert occupation but which is additionally entangled in our conception of modernity in humans.

Another critical issue is the degree to which deserts are actually homogeneous and represent a uniform bloc of physical attributes. Do they have uniform characteristics both across subregions and through time? How real is the concept of the desert culture bloc and the conservative nature of the societies occupying such a monolithic construct? The chapters from Australia, Africa, and the Americas suggest that this assumption needs to be challenged at a number of levels.

When an ecological and biogeographic approach is taken in an examination of desert systems (after Smith 1989; Veth 1993) it becomes apparent that adjacent areas are likely to have presented a variety of optimal situations for hunter-gatherers to establish different kinds of habitation loci, to target varied prey, to engage in different forms of residential and logistical mobility patterns, and to engage in different rhythms of aggregation and dispersion depending on local and regional climate patterns. For Aboriginal groups to structure their use of the Lake Eyre Basin of Australia, which only receives floodwaters from the north on average once every ten years, is quite a different scenario to persistence of human occupation in the central Australian ranges, where permanent water "oases" have been present since the Tertiary period (cf. Hughes and Hiscock in press).

Not only is physical variation across desert systems arguably of relevance to hunter-gatherers; there are also the different climate histories which will have impact at both the regional and local levels and which will serve to make conditions either more marginal and "risky" or increase the productivity and reliability of economic resources – both inviting changes in social and technological organization.

The need to accurately contextualize the archaeological record against an environmental framework has, in the past, been hampered by our rudimentary knowledge of the impacts of changing climatic conditions on arid regions across the world (Veth et al. 2000; see also Chapter 3, this volume). This is largely seen as a direct consequence of the general absence of appropriate, uninterrupted data-sets on which to base interpretations, and environmental conditions that are often not conducive to the preservation of organic materials. While dry, arid conditions can be excellent for the preservation of macroscopic organic remains in sheltered archaeological sites, they usually result in extreme degradation of fragile pollen grains in open contexts that otherwise would serve as vegetation markers allowing inferences to be made about climatic change. Reconstruction of climate based on pollen analyses in arid regions is further frustrated by the absence of useful indicator types and the generally non-specific nature of the grassland pollen types which usually dominate such assemblages. Nevertheless, in recent decades a more sophisticated understanding of environmental change in arid regions has begun to emerge.

Forced by necessity, paleoenvironmental researchers interested in the arid zone have focused on sedimentary, stratigraphic, geochemical, mineralogical, and geomorphological investigations of fluvial and lacustrine systems (e.g., Bowler 1998; Magee and Miller 1998; Vogel 1989). In addition, recent developments in luminescence and U-series dating have greatly assisted the study of aeolian sediments, tufa formations, and speleothems in arid landscapes (e.g., Brook et al. 1996; Brook et al. 1999). More novel data-sets relevant to paleoenvironmental research in low-altitude deserts within Australia, South America, and North America include botanical materials preserved in stick-nest rat middens (e.g., Betancourt et al. 1990; Latorre et al. 2002; Pearson and Dodson 1993). Tufa formations, speleothems, and mud-wasp nests have also been recently recognized for their value in preserving vegetation indicators, such as pollen and phytoliths, in arid regions of the world (e.g., Burney et al. 1994; Roberts et al. 1997; Wallis 2002, 2003).

Other data of relevance to reconstruction of desert environments may sometimes be available from offshore marine cores that preserve indicators such as diatoms, foraminifera, pollen, phytoliths, isotopes, and charcoal, as well as from high resolution coral records. Similarly, ice cores in or adjacent to high-altitude deserts offer unique insights into climate change, often at a much higher resolution than is typically afforded by the archaeological record (e.g., Shimida et al. 1991; Thompson et al. 1998).

Proxy data from archaeological cave sites (such as faunal remains, macrofloral material, phytoliths, and charcoal) may also provide valuable clues as to what the environment was like in the past (e.g., Bowdery 1998; Esterhuysen and Mitchell 1996; McConnell and O'Connor 1997; Robbins et al. 1996; Smith et al. 1996; Wallis

2001). However, the interpretation of such assemblages in terms of paleoenvironmental reconstruction is considerably more difficult, owing to the potential bias in the materials present caused by anthropogenic behaviors. In summary, there is still an enormous amount of work to be carried out in placing archaeological sequences from what are now deserts in accurately reconstructed past environmental contexts.

Overall, this book is intended as an issues-based volume, rather than a series of regional overviews, but each chapter includes extended case studies illustrating key issues. A similar interdisciplinary approach (but on a different topic) was successfully adopted in *The Archaeology of Prehistoric Coastlines* (Bailey and Parkington 1984) and we believe that a comparable examination of human life in deserts provides an equally productive and provocative framework for future work.

There is a strong international demand for knowledge about the dynamics of human settlement in arid regions. The history of humans in arid lands can be used as a tool for developing knowledge about the evolution of desert systems, and understanding environmental changes currently underway there or likely to take place in the near future. We hope this volume satisfies at least some of this demand.

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