Quaternary Science Reviews 197 (2018) 193–208

Contents lists available at ScienceDirect

Quaternary Science Reviews

journal homepage: www.elsevier.com/locate/quascirev

Evidence for reduced environmental variability in response to increasing human population growth during the late Holocene in northwest Tasmania, Australia

Anthony Romano, Michael-Shawn Fletcher*

School of Geography, University of Melbourne, 221 Bouverie Street, Parkville, Melbourne, Australia

ARTICLE INFO

Article history:
Received 20 March 2018
Received in revised form
2 July 2018
Accepted 2 July 2018

Keywords:
Holocene
Tasmania
Human-environment interactions
Palaeoecology
Archaeology
Fire
Rate-of-change analysis

ABSTRACT

A fundamental tenet of human land management is to create spatial and temporal predictability in an environment to improve subsistence. Detecting the relationship between humans and their environment in the palaeo-record is confounded by a number of factors, not the least of which is an adequate pairing of the scales of both the palaeoecological and archaeological records. We aimed to determine the impact, if any, of Aboriginal occupation on the environment surrounding an occupation site in northwest Tasmania, Australia. We analysed the sediments within two small wetlands in northwest Tasmania for pollen, charcoal and loss-on-ignition: (1) a high intensity occupation site —with direct evidence of human occupation; and (2) a low intensity occupation site —with no direct evidence of human occupation. Fire activity and environmental variability covaried at both sites in response to regional climatic change, except between ca. 1700-900 cal yr BP. This period is synchronous with peak human population growth in the region derived from statistical manipulation of the regional (northwest Tasmanian) archaeological dataset. During this period, the high intensity occupation site experienced a peak in fire activity along with a marked reduction in the rate-of-change, reflecting a phase of low variability at a time of increased climatic variability and peak human population growth, while the low intensity occupation site maintained the positive relationship between fire activity, and climatic and environmental variability experienced by both sites at other times. We contend that increased human occupation intensity between ca. 1700 to 900 cal yr BP led to an increased intensity of land management and a resultant decrease in environmental variability as people actively managed the landscape to create a stable and predictable environment.

1. Introduction

As we currently grapple with rapid and widespread global environmental and climatic changes and strive to achieve the global imperative of sustainability (Goodland, 1998; Dearing et al., 2008; Seddon et al., 2014), it is fundamental that we understand human-environment interactions over time so that we can fully appreciate how and why our activities influence environmental systems. This is particularly important for landscapes recently colonised by Europeans in which imported landscape management paradigms have resulted in widespread environmental degradation (Bradshaw, 2012). In Australia, for example, the impact that Aboriginal people on the environment remains a contentious topic with several conflicting hypotheses that range from benign opportunism to wilful mastery (e.g. Horton, 1982; Bowman, 1998; Langton, 1998; Gammage, 2011). The recent increase in catastrophic landscape-scale fires in Australia (Sharples et al., 2016) has been attributed, in part, to the disruption of millennia of fire manipulation by indigenous Australians to manage their landscapes (Marsden-Smedley, 1998; Russell-Smith et al., 2003; Attiwill and Adams, 2013). Thus, understanding how Aboriginal people influenced Australian landscape evolution is important, not only for informing debates about past fire practices but, for managing the landscape systematically, skilfully and sustainably (Russell-Smith et al., 1997; Hill et al., 1999; Marsden-Smedley and Kirkpatrick, 2000; Yibarbuk et al., 2001; Scherjon et al., 2015). Interdisciplinary approaches to understanding long-term human-environment interactions that combine palaeoecology and archaeology

* Corresponding author.
E-mail address: michael.fletcher@unimelb.edu.au (M.-S. Fletcher).

https://doi.org/10.1016/j.quascirev.2018.07.001
0277-3791/

have the potential to provide key insights into the historical legacy of humans on landscapes and how inhabited landscapes have evolved in concert with humans. Here, we compare high resolution palaeoecological data with archaeological data and archives of climatic change in an attempt to understand long-term human environment interactions in northwest Tasmania, Australia, a region with evidence for a long history of human occupation, but from where there is a dearth of complementary palaeoenvironmental data.

A fundamental tenet of land management is to create spatial and temporal predictability in an environment to improve subsistence. Modern humans first colonised Australia at least 60–70,000 years ago (60–70,000 cal yr BP) (Clarkson et al., 2017), with the continental island of Tasmania first settled by ca. 38,000 cal yr BP (Cosgrove, 1999). The principal tool with which Aboriginal people have managed the Australian environment throughout this time is fire. The rationale for use of fire as a landscape management tool is straightforward and evident across most cultures in the world (Scherjon et al., 2015): fires are used to promote fresh, new plant growth to attract game (to then hunt), to create open passages to traverse, to promote plant foods, and to protect areas of occupation (Head, 1994; Russell-Smith et al., 1997; Langton, 1998; Yibarbuk et al., 2001; Whitehead et al., 2003; Bliege-Bird et al., 2008, 2013; Scherjon et al., 2015). The central role of fine-scale Aboriginal mosaic burning in the evolution of the Australian landscape is evident from the radical transformation of the Australian landscape following British invasion in the 18th century and the subsequent cessation of traditional fire management over much of the continent (Gammage, 2011). Outside areas cleared for farmland and other colonial purposes, this shift in fire regime resulted in widespread woody encroachment of open landscapes (e.g. Lunt, 1998; Gammage, 2011), and a subsequent increase in landscape-scale fires that are associated with species extinctions and biodiversity loss (Marsden-Smedley, 1998; Bradstock et al., 2002; Bird et al., 2008; Holz et al., 2015). While these changes reveal a profound influence of Aboriginal people over the Australian landscape, such evidence remains elusive and much debated in the palaeoenvironmental record (Bowman et al., 2016).

Understanding human-environment interactions has emerged as a prominent research agenda within both archaeology and palaeoecology (e.g. Anderson et al., 2006; Dearing, 2006; Costanza et al., 2007; Cooper and Peros, 2010; Kintigh et al., 2014; Seddon et al., 2014a; Holmgren et al., 2016; Fernández-López de Pablo et al., 2018). Palaeoenvironmental research has demonstrated the important role that climate has in determining the development and distribution of ecosystems, however the impact of humans on ecosystems and of environmental change on humans remains contentious, particularly when studies of environmental change are conducted in isolation from archaeology (Coombes and Barber, 2005; Briggs et al., 2006; Munoz et al., 2010; Caseldine and Turney, 2010). While integrated studies of environmental and archaeological changes can provide valuable insights into human-environment interactions (Dearing et al., 2006; Dearing, 2006; England et al., 2008; Munoz et al., 2010), such insights are often limited by the varying temporal and spatial scales represented by palaeoecological and archaeological data (Thomas, 1993; Cooper and Peros, 2010). A case in point is the attribution of broad-scale (regional or continental-scale) environmental and climatic changes to understanding trends in site-based archaeological data (e.g. Cosgrove et al., 1990; Cosgrove, 1999; Hiscock, 2002, 2006; Genever et al., 2003; Bickford and Gell, 2005; Holdaway and Fanning, 2010).

Despite the longevity of occupation, ascertaining the influence of Aboriginal people on the Australian environment remains challenging. This elusiveness stems from, among a range of confounding factors, (1) the central role fire plays in Australian landscape dynamics irrespective of humans, (2) the paucity of coupled and appropriately scaled palaeoenvironmental and archaeological records, and (3) the insensitivity of many palaeoecological sites and proxies (eg. poor pollen taxonomic resolution) to the fine-scale environmental change associated with Aboriginal land management with fire. Here, we present two high-resolution records of fire (charcoal), vegetation (pollen) and wetland sedimentary changes (loss-on-ignition) spanning the last ca. 6000 years from northwest Tasmania, Australia. We attempt to mitigate some of the confounding factors inherent in coupled palaeoecological-archaeological studies in Australia by selecting two small wetland sites that record local-scale environmental change in northwest Tasmania, Australia: one that is adjacent to a known human occupation site and a valuable spongelite quarry – a high intensity occupation site; and one at which there is no direct evidence of human occupation – a low to no intensity occupation site. The study area is recognised as a cultural landscape created by millennia of Aboriginal land management with fire: the Western Tasmanian Aboriginal Cultural Landscape. We compare our environmental data with a reanalysis of the existing local (northwest Tasmanian) archaeological record and with data recording regional climatic change in an attempt to understand effects of fire, climate and people on long-term environmental change in the study area. We hypothesise that the response of the local environment around high intensity human occupation sites to changes in climate will differ from areas of low to no human occupation intensity. We further hypothesise that an increase in the intensity of human occupation will result in reduced local-scale environmental variability around high intensity occupation sites, relative to low occupation intensity sites, as people attempt to create a stable and predictable environment in which they live. Increased occupation of an area would, presumably, increase resource demands, prompting more intense and/or targeted, management effort in order to secure resources. More frequent/targeted burning, for example, would promote young shoot formation that would attract and retain game, while increased occupation would also carry with it social responsibilities of country keeping that are principally carried out using fire in Australian indigenous societies. The net result of increased occupation intensity, then, would be a more predictable and profitable landscape in response to increased anthropogenic burning.

2. The study region

2.1. Northwest Tasmania

Tasmania (41–44°S and 144–149°E) is a large continental island, intermittently separated from southeast Australia by the Bass Strait (a shallow sea ca. 120 m deep). Northwest Tasmania (40°S and 144°E) consists predominantly of low-lying areas, with a Pleistocene interglacial coastline extending up to 15 km inland. The low plateaus host restricted areas of rainforest, wet-sclerophyll (*Eucalyptus* spp.) forests interspersed with *Acacia* spp. and areas of swamp forest dominated by *Melaleuca* and *Leptospermum* species (Kitchener and Harris, 2013). Coastal margins host extensive areas of sedge- and heathlands (comprised of *Banksia marginata*, *Sprengelia incarnata, Amperea xiphoclada, Epacris* spp.), *Leptospermum* spp. scrub, *Melaleuca* spp. swamp-forests (*Melaleuca* spp. and *Acacia* spp.) and native grasslands (Kitchener and Harris, 2013). The climate is temperate maritime with mild winters and cool summers. Precipitation decreases northwards, with average annual rainfall decreasing from 2000 mm in the south to 600 mm in the north. Average daily temperatures range from 6 °C to 24 °C annually. Inter-annual precipitation variability in Tasmania is