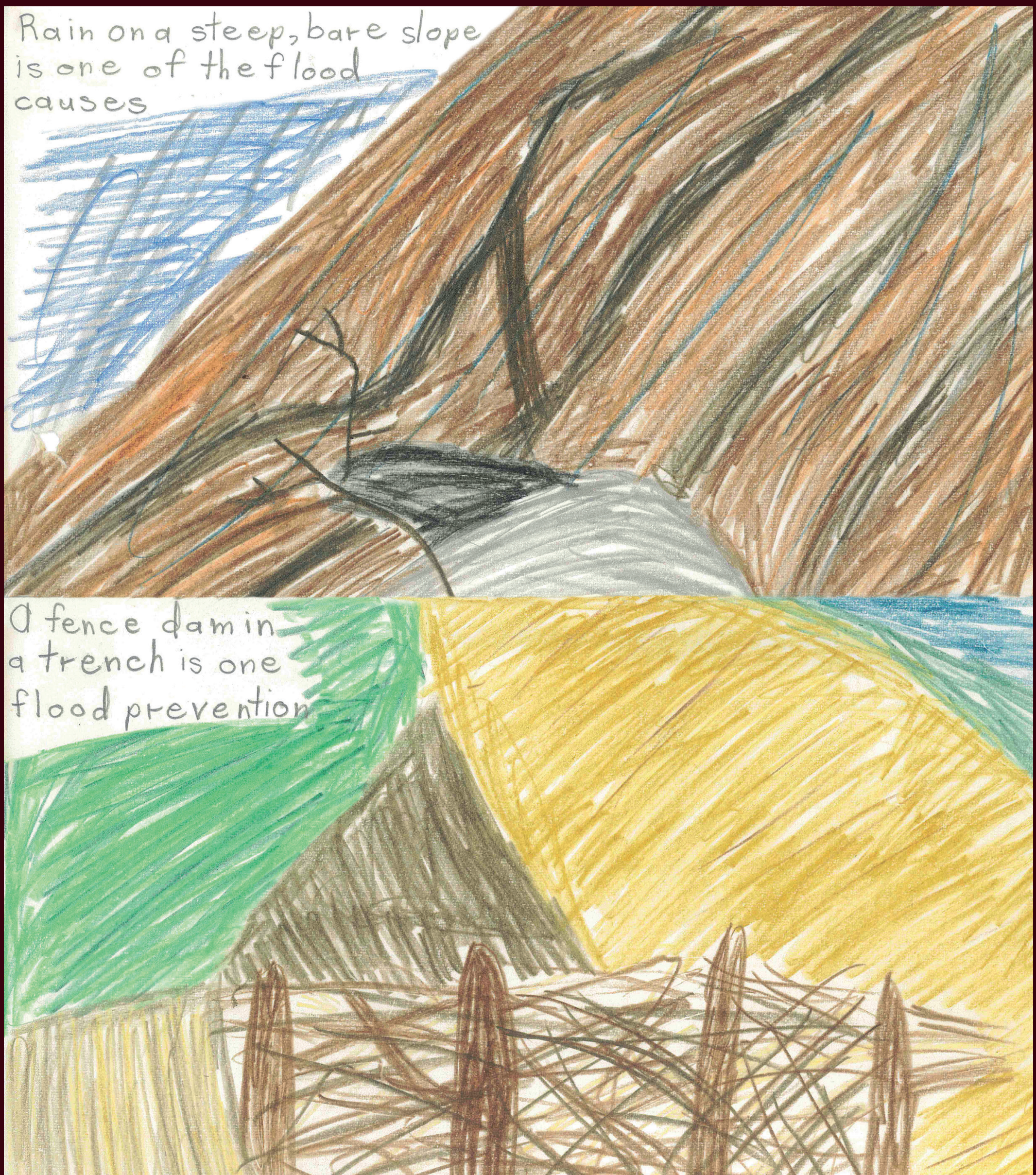
McDONALD INSTITUTE CONVERSATIONS

Inspired geoarchaeologies: past landscapes and social change

Essays in honour of Professor Charles A. I. French

Edited by Federica Sulas, Helen Lewis & Manuel Arroyo-Kalin



Inspired geoarchaeologies

McDONALD INSTITUTE CONVERSATIONS

Inspired geoarchaeologies: past landscapes and social change

Essays in honour of Professor Charles A. I. French

Edited by Federica Sulas, Helen Lewis & Manuel Arroyo-Kalin

with contributions from
Michael J. Allen, Andrea L. Balbo, Martin Bell, Nicole Boivin, Christopher Evans, David Friesem, Kasia Gdaniec, Lars Erik Gjerpe, Michael Gill, Martin Green, Ann-Maria Hart, Robyn Inglis, Martin Jones, Gabriella Kovács, Helen Lewis, Johan Linderholm, Roy Loveday, Richard I. Macphail, Caroline Malone, Wendy Matthews, Cristiano Nicosia, Bongumenzi Nxumalo, Innocent Pikirayi, Tonko Rajkovaca, Rob Scaife, Simon Stoddart, Fraser Stuart, Federica Sulas & Magdolna Vicze

Published by:
McDonald Institute for Archaeological Research
University of Cambridge
Downing Street
Cambridge, UK
CB2 3ER
(0)(1223) 339327
eaj31@cam.ac.uk
www.mcdonald.cam.ac.uk

ISBN: 978-1-913344-09-2

On the cover: *Hand drawn illustration by Charly French, aged around 10 years old. Courtesy of Kasia Gdaniec.*

Cover design by Dora Kemp and Ben Plumridge.
Typesetting and layout by Ben Plumridge.

Edited for the Institute by Matthew Davies (*Series Editor*).

Contents

Contributors

Michael J. Allen
Allen Environmental Archaeology, Redroof, Green Road, Codford, Wiltshire, BA12 0NW, UK
Email: aea.escargots@gmail.com
Mike's (BSc, PhD, MCIfA, FLS, FSA) research and geoarchaeological interest was originally based around the analysis of colluvium and land snails, including in the South Downs, Dorchester, Cranborne Chase, Stonehenge and Avebury in particular; these were the subject of both his undergraduate and PhD research. He has combined a career dominated by commercial archaeology with involvement in university research projects and as a staff lecturer at Sussex, Bournemouth and Oxford Universities. He was Environmental Manager at Wessex Archaeology for twenty years and for fifteen years has run his own geoarchaeological consultancy from a purpose-built bespoke lab, where he is involved in research designs and coordination of environmental archaeology from fieldwork to publication. Projects have been as diverse as intertidal zone research and Maltese prehistoric temples. His interests now lie principally in landscape archaeology and the development and creation of landscapes through prehistoric human intervention. He has worked with – and still is working with – Charly French in Cranborne Chase, the Stonehenge Riverside Project, and both recent Avebury landscape projects. He is vice-president of the Conchological Society, and as founding editor of the Prehistoric Society Research Papers has seen ten peer-reviewed volumes through to publication.

Manuel Arroyo-Kalin
Institute of Archaeology, University College London, 31–34 Gordon Sq., London WC1H 0PY, UK
Email: m.arroyo-kalin@ucl.ac.uk
Manuel is Associate Professor of Geoarchaeology at the Institute of Archaeology, UCL. He is interested in the Anthropocene, Human Niche Construction, and Historical Ecology and uses earth science methods, including soil micromophological analysis, to study past anthropic landscape modification and anthropogenic soil formation. His main research focus is the pre-Colonial human landscape history of tropical lowland South America, particularly the Amazon basin, where he is engaged in the long-term comparative study of Amazonian Dark Earths. He has also been involved in geoarchaeological studies in other world regions and published on the archaeology and palaeodemography of the Amazon basin. In recent years he has coordinated an intercultural and interdisciplinary research project focused on the northwest Amazon region.

Andrea L. Balbo.
Platform Anthropocene, 160 Riverside Blvd, 30E - 10069 New York, NY, USA
Email: andrea.balbo@planthro.org
Following his PhD at the University of Cambridge (2008), Andrea conducted geoarchaeological research at the Spanish Research Council (CSIC) and at the University of Hamburg. Since 2019 he has been employed at the ALIPH Foundation for the protection of heritage in conflict areas, based in Geneva, where his main focuses are the linkages between climate change, conflict and cultural heritage protection, and the role of documentation and ICT in cultural heritage protection. Co-founder and CEO of Platform Anthropocene Ltd., Andrea leads the development of a comprehensive interdisciplinary web repository on the Anthropocene. He also maintains university teaching in archaeology, heritage and human-environment interaction and acts regularly as a scientific evaluator, rapporteur, and monitor for the European Commission.

Martin Bell
Department of Archaeology, University of Reading, Whiteknights, PO Box 217, Reading, Berkshire, RG6 6AH, UK
Email: m.g.bell@reading.ac.uk
Martin is an emeritus professor of Archaeology at Reading University. His research interests are in geoarchaeology, environmental archaeology, coastal and maritime and experimental archaeology. He has been involved in several experimental archaeology projects, particularly the Experimental Earthwork Project. He has been excavating coastal sites in the Severn Estuary for forty years and has produced four monographs on the prehistory of the Severn Estuary. He believes that environmental archaeology has a key role in finding sustainable strategies for nature conservation. His most recent book *Making One's Way in the World: The Footprints and Trackways of Prehistoric People* (Oxbow 2020) explores the ways in which we can investigate prehistoric routeways and connectivity. He is a Fellow of the British Academy and the Society of Antiquaries of London.

Nicole Boivin
Max Planck Institute for the Science of Human History, Kahlaische Strasse 10, 07745 Jena, Germany
Email: boivin@shh.mpg.de
Nicole was a director at the Max Planck Institute for the Science of Human History in Jena, Germany. The author of *Material Cultures, Material Minds: The*

Role of Things in Human Thought, Society and Evolution (Cambridge University Press 2008), she has also been editor of several books, including *Globalisation and the 'People without History': Understanding Contact and Exchange in Prehistory* (Cambridge University Press 2018). She has been awarded research funding from many international bodies, including the European Research Council and the National Geographic Society, is a Fellow of the Society of Antiquaries of London, and holds an Honorary Professorship at the University of Queensland.

Christopher Evans
Department of Archaeology, University of Cambridge, Downing Street, Cambridge CB2 3DZ, UK
Email: cje30@cam.ac.uk
Christopher was the executive director/director of research of the Cambridge Archaeological Unit (CAU), University of Cambridge until 2021. Having worked in British archaeology for over forty years – with his initiation to Fenland archaeology coming at Fengate – following on from the Haddenham Project, he co-founded the CAU with Ian Hodder in 1990. He has directed a wide variety of major fieldwork projects, both abroad – Nepal, China and Cape Verde (the latter sometimes involving Charly) – and in the United Kingdom. A fellow of the Society of Antiquaries of London, in 2018 he was elected a fellow of the British Academy. He has published widely, including monographs arising from both his own landscape projects and those of earlier-era practitioners in the CAU's 'Historiography and Fieldwork' series (e.g. Mucking in 2016). Together with Tim Murray, he edited Oxford University's *Histories of Archaeology: A Reader in the History of Archaeology* (2008).

David Friesem
Department of Maritime Civilizations, School of Archaeology and Maritime Cultures, University of Haifa, 199 Aba Khoushy Ave, Mount Carmel, Haifa 3498838, Israel
Email: dfriesem@univ.haifa.ac.il
David is a senior lecturer of environmental archaeology at the Department of Maritime Civilizations, University of Haifa, and a research member of the Haifa Center for Mediterranean History. He combines field archaeology, geoarchaeology, ethnography, and social theory in order to study human ecology, technology, and social interactions, and reconstruct the often-missing small-scale perspective of human-environment interactions. His research interests include human adaptation during the Late Pleistocene, the emergence of complex societies, and hunter-gatherer anthropology.

Kasia Gdaniec
Higher Shippon, Bridge Reeve, Chulmleigh, Devon EX18 7BB, UK
Email: kasia.gdaniec@btinternet.com
Kasia works as an archaeological curator at Cambridgeshire County Council, advising local planning authorities on managing change to the historic environment, and scoping investigation programmes for developers and commercial archaeologists that promote both academic rigour and public engagement. Her particular interests lie in the technical difficulties of preservation *in situ* as a long-term archaeological management technique, the ceramic traditions of Neolithic and Bronze Age Britain, the evolution of the East Anglian fens and the adaptation of local communities to their changing environments, and the history and legacy of post-medieval fen draining schemes and how this shapes current competing land use and environmental pressures.

Michael Gill
48 Saunders Avenue, Salisbury, SP1 3PQ, UK
Email: mjg.gbr@gmail.com
Michael has an MA in Landscape Studies (archaeology and history) and an MSc in Geographical Information Systems, both from Leicester University. He works as a GIS consultant with Ordnance Survey, and is an active member of Avon Valley Archaeological Society, where he leads the geophysics survey team. He has a personal research interest in the Neolithic monuments on Cranborne Chase and in the Avon Valley, and has surveyed a number of long barrows and related sites in this region.

Lars Erik Gjerpe
Cultural History Museum, University of Oslo, Frederiks gate 2, 0164 Oslo, Norway
Email: l.e.gjerpe@khm.uio.no
Lars has a Masters and PhD in archaeology from the University of Oslo, with a thesis on Iron Age settlement and property rights in southeastern Norway. He has directed several large-scale heritage management excavations for the Museum of Cultural History at the University of Oslo, mainly targeting Iron Age burials, settlements and agricultural remains, while including other periods and relics. As a result, he has been editor and main author of publications on cemeteries (*Gravfeltet på Gulli*, University of Oslo 2005) and Iron Age settlements. Interdisciplinary cooperation and environmental archaeology, including archaeometric analysis (e.g. seeds, charcoal and soil), have been an integrated part of these projects. He has also been editor for the journal *Primitive tider* and academic editor of Trond Løken's 2020 *Bronze Age and Early Iron*

Age House and Settlement Development at Forsandmoen, South-western Norway. Currently, he is a member of the steering committee for large-scale heritage management excavations at the NTNU (Norwegian University of Science and Technology).

Martin Green
Down Farm, Woodcutts, Salisbury SP5 5R, UK
Email: mgreendownfarm@gmail.com
Martin began a fieldwalking survey as a lad on Cranborne Chase in the latter 1960s. Following experience gained on a number of field projects, he began excavating independently in the region in 1976. He joined Richard Bradley's and John Barrett's Cranborne Chase Project the following year, contributing four site excavations to *Landscape, Monuments and Society* in 1991. He continued independent fieldwork in the early 1990s in collaboration with Mike Allen, in particular on the Fir Tree Field shaft which revealed a remarkable sequence of deposits dating from the late Mesolithic to the Beaker period, and worked with Charly French on the Upper Allen Valley Project 1998–2003, contributing four further site excavations to *Prehistoric Landscape Development and Human Impact in the Upper Allen Valley, Cranborne Chase, Dorset* (2007). Since that time, he has continued independent research, also in collaboration with Josh Pollard and Southampton University, on the Dorset Cursus, on Down Farm and in the Knowlton environs whilst continuing to increase the biodiversity on his small farm. He was made an FSA (Fellow of the Society of Antiquaries) in 2004 and received an honorary Doctor of Science degree from Reading University in 2006.

Ann-Maria Hart
Ann-Maria is currently working in contracts and commercial management within the Australian defence industry, but still maintains an interest in her former career as a geoarchaeologist.

Robyn Inglis
York Environmental Sustainability Institute (YESI), K/220, Department of Biology, Wentworth Way, University of York, Heslington, York YO10 5DD, UK
Email: robyn.inglis@york.ac.uk
Robyn is a geoarchaeologist interested in the formation of the archaeological record and its impact on our understanding of Palaeolithic dispersals. After receiving her BA in Archaeology and Anthropology from Cambridge, she gained her MSc in Geoarchaeology from Reading. Her PhD in the McBurney Laboratory focussed on the micromorphological reconstruction of sedimentation at the Haua Fteah, Libya, and its implications for understanding human/environment interactions. From 2011–8 she led geoarchaeological survey in Saudi Arabia to further understand the Palaeolithic occupation of the Red Sea littoral and its role in hominin dispersals, first as part of the DISPERSE project at the University of York, and later as a Marie Skłodowska-Curie Global Fellow (University of York and Macquarie University). She now works in research development at the York Environmental Sustainability Institute, University of York, and is an Honorary Research Associate in the university's Department of Archaeology.

Martin Jones
Department of Archaeology, University of Cambridge, Downing Street, Cambridge CB2 3DZ, UK
Email: mkj12@cam.ac.uk
Martin was the first George Pitt-Rivers Professor of Archaeological Science at the University of Cambridge. He works on archaeobotany and archaeogenetics, in the context of the broader archaeology of food. In his earlier career he explored the development of agriculture in later prehistoric and Roman Europe, after which he was very much involved in the development of biomolecular approaches within archaeology. These he applied to research into the spread of farming of both major and minor crops across Asia, most recently in the context of the Food Globalization in Prehistory Project. His latest project is exploring the co-evolution and Eurasian biogeography of crops and bees.

Gabriella Kovács
Matrica Museum and Archaeological Park, 2440 Százhalombatta, Gesztenyés út 1–3, Hungary
Email: antropologus@yahoo.com
Gabriella (PhD) is a museologist and soil micromorphologist at the Hungarian National Museum National Institute of Archaeology. Her main interest is the Middle Bronze Age tell settlement of Százhalombatta-Földvár, under the framework of the international SAX (Százhalombatta Archaeological Expedition) project. Besides this site, other Bronze Age settlements of Hungary are also part of her research interests, regarding the comparison of single and multi-layered settlements of the period, mainly the so-called Vatya Culture. She focuses on the use of space and building techniques via soil micromorphology to add details to traditional archaeological methods.

Helen Lewis
School of Archaeology, University College Dublin, Dublin 4, Ireland
Email: helen.lewis@ucd.ie
Helen is an associate professor at University College Dublin School of Archaeology. Her background is in archaeology and anthropology (BA University of

Toronto), environmental archaeology (MSc University of Sheffield) and archaeological soil micromorphology (PhD University of Cambridge). She mostly works today on cave sites in Southeast Asia, but she still loves northwest European Neolithic and Bronze Age monuments and landscapes, and ancient agricultural soils.

Johan Linderholm
Environmental Archaeology Laboratory (MAL),
University of Umeå, S-90187 Umeå, Sweden
Email: johan.linderholm@umu.se
Johan trained in archaeology and chemistry, specializing in soils and archaeology (BSc and MSc Umeå University). His PhD dealt with soil chemical aspects on settlement organization over time and general human impact on soils. He has been working with research and contract archaeology in several large projects over the last thirty years, mainly in Scandinavia but also in Gibraltar, Italy, France and the UK. Currently he holds a position as associate professor at Umeå University and is conducting research related to reflectance spectroscopy at the Environmental Archaeology Laboratory (MAL), University of Umeå.

Roy Loveday
School of Archaeology and Ancient History,
University of Leicester, University Road, Leicester
LE1 7RH, UK
Email: r.e.loveday@btinternet.com
Roy is an honorary research fellow in the School of Archaeology and Ancient History, University of Leicester. He completed a PhD surveying cursuses and related monuments of Great Britain in 1985. His particular interests are the societal mechanisms underlying monument plan transmission and construction.

Richard I. Macphail
Institute of Archaeology, University College
London, 31–34 Gordon Sq., London WC1H 0PY, UK
Email: r.macphail@ucl.ac.uk
Richard trained in geology and geography, specializing in soil science (BSc Swansea University). An MSc in pedology and soil survey (Reading University) prepared him for a soil science PhD on podzol development on heathlands (Kingston Polytechnic). An English Heritage-funded archaeological soil contract at the Institute of Archaeology (University College London) provided further training and international research opportunities were developed, including working with the Soil Survey of England and Wales and Macaulay Institute, UK, the CNRS, France, and the Soprintendenza, Italy. This led to the publication of *Soils and Micromorphology in Archaeology* (with Courty and Goldberg; Cambridge University Press 1989), the founding of the International Archaeological Soil Micromorphology Working Group, and training weeks at UCL. As a result, *Practical and Theoretical Geoarchaeology* (Blackwell 2006; Wiley 2022) and *Applied Soils and Micromorphology in Archaeology* (Cambridge University Press 2018), both with Goldberg, were written. Macphail is a recipient of the Geological Society of America's Rip Rapp Award for Archaeological Geology (2009), and is a fellow of the Geological Society of America. He is also the 2021 co-awardee (with P. Goldberg) of the International Union of Soil Sciences Tenth Kubiëna Medal for Soil Micromorphology. The paper included here also reflects more than two decades of research across Scandinavia.

Wendy Matthews
Department of Archaeology, University of Reading,
Whiteknights, PO Box 217, Reading, Berkshire, RG6
6AH, UK
Email: w.matthews@reading.ac.uk
Wendy is a specialist in Near Eastern Archaeology and geoarchaeology, focusing on micromorphology of the built environment and long-term perspectives on sustainability (MA Edinburgh 1984; PhD Cambridge 1992, 'Micromorphology of occupational sequences and use of space in a Sumerian city'). She was a research associate and fellow of the McDonald Institute (1993–2000) and is an associate professor in Archaeology at the University of Reading, following a semester as visiting lecturer at UC Berkeley. She was a member of the *Çatalhöyük* team and steering committee, Turkey (1993–2017). She co-directs the *Central Zagros Archaeological Project* investigating the Neolithic of the Eastern Fertile Crescent, Iraq, Iran (2007–), and has conducted research in Syria and Bahrain. She has co-supervised twenty-two PhD students and teaches modules on past, present and future sustainability; micromorphology; and Mesopotamia. She co-designed a new prehistory gallery at the Slemani Museum with Iraqi and Reading colleagues, with sustainability as a central theme.

Cristiano Nicosia
Dipartimento di Geoscienze, Università di Padova,
Via Gradenigo 6, 35131 Padova, Italy
Email: cristiano.nicosia@unipd.it
Cristiano is a geoarchaeologist working as full professor at the Department of Geosciences of the University of Padova, Italy. His research focuses on the study of anthropic deposits, on alluvial geoarchaeology, and on the human impact on soils and landscapes. He is currently the principal investigator of the ERC-funded GEODAP project (GEOarchaeology of DAily Practices: extracting Bronze Age lifeways from the

domestic stratigraphic record). He is involved as chief geoarchaeologist in several Italian archaeological projects and directs the excavations of the Bronze Age site of La Muraiola di Povegliano (Verona) and of the mid-Neolithic site of Molino Casarotto (Vicenza). He collaborates as field geoarchaeologist and micromorphologist in research projects at Olduvai Gorge (Tanzania), Petra (Jordan), Pompeii (Italy), Damyanitsa (Bulgaria), and the Jiroft plain (Iran). In 2017 he co-edited with G. Stoops the volume *Archaeological Soil and Sediment Micromorphology*, published by Wiley.

Bongumenzi Nxumalo
Department of Anthropology and Archaeology, Faculty of Humanities, Hatfield Campus, University of Pretoria, Private Bag X20, Hatfield 0028, South Africa
Email: u12378624@tuks.co.za
Bongumenzi (PhD 2020, Cantab.) is lecturer in archaeology at the Department of Anthropology and Archaeology, University of Pretoria. His research interests include hydrological modelling, geoarchaeology, the evolution of early state-societies, historical and modern climatic records.

Innocent Pikirayi
Department of Anthropology and Archaeology, Faculty of Humanities, Hatfield Campus, University of Pretoria, Private Bag X20, Hatfield 0028, South Africa
Email: innocent.pikirayi@up.ac.za
Innocent (PhD 1993, Uppsala) is professor in archaeology at the University of Pretoria. His research interests include geoarchaeology, development of ancient complex societies, water and social formation, and climate change.

Francis Pryor
Inley Drove Farm, Sutton St James, Spalding PE12 0LX, UK
Email: pryorfrancis@gmail.com
Francis has studied the archaeology of the Fens since 1971. His major excavations in the region took place near Peterborough at Fengate, Maxey and Etton. In 1982 his team's survey of fenland drainage dykes revealed the timbers of a waterlogged Bronze Age timber platform and causeway at Flag Fen, which was opened to the public in 1989. He was a member of Channel 4's long-running series *Time Team*. He has written many popular books including *Seahenge* (2001), *Britain BC* (2003), *Britain AD* (2004), *The Making of the British Landscape* (2010), *Home* (2014), *Stonehenge* (2016) and *The Fens* (2019). His most recent book is *Scenes from Prehistoric Life* (Head of Zeus 2021).

Tonko Rajkovaca
Charles McBurney Laboratory for Geoarchaeology, Department of Archaeology, University of Cambridge, Downing Street, Cambridge CB2 3DZ, UK
Email: tr251@cam.ac.uk
Tonko is chief research laboratory technician in geoarchaeology at the University of Cambridge. Involved in archaeology since his childhood, he held posts of archaeological site director and museum curator in Serbia (pre-1994) before moving to the UK to specialize in the late Upper Palaeolithic archaeology of ex-Yugoslavia via an MPhil (2004) at the University of Cambridge, and a PhD at the University of Ljubljana (2017). After four years at the Cambridge Archaeological Unit, he took up the post of geoarchaeology technician at the Department of Archaeology in 2008, and since then he has been working at the McBurney Laboratory of Geoarchaeology. He has directed and managed several archaeological projects, field and laboratory training in the UK and eastern Europe. He has authored several volumes and articles, including a monograph on preventive archaeology in ex-Yugoslavia published by Belgrade's Institute of Archaeology (2019) and a manual of archaeological excavation (co-authored with J. Appleby, 2015).

Rob Scaife
Palaeoecology, University of Southampton, University of Southampton University Road, Southampton SO17 1BJ, UK
Email: r.scaife@soton.ac.uk
Rob is a visiting professor of palaeoecology and environmental archaeology at the University of Southampton, and an honorary research associate of the McDonald Institute for Archaeological Research at the University of Cambridge. His first degree was in geography with geology, and an interest in the Pleistocene led him into palynology. He investigated the Late and Post-glacial vegetation changes of the Isle of Wight for his PhD (King's College London). Subsequently, he worked at the Institute of Archaeology, London, and the Ancient Monuments Laboratory at English Heritage. As a freelance palaeoecologist, he has continued to work across southern and eastern England, along with international studies in Italy, Turkey, Peru and Chile.

Simon Stoddart
Magdalene College, Cambridge, CB3 0EU, UK
Email: ss16@cam.ac.uk
Caroline Malone
8 Lansdowne Road, Cambridge, CB3 0EU, UK
Email: c.malone@qub.ac.uk
Simon and Caroline have been engaged in the research of ancient landscapes for nearly forty years, with a

focus on the central Mediterranean. They both attended lectures by Keith St. Joseph, Richard West, Nick Shackleton and John Coles on the outlines of environmental archaeology. Simon Stoddart went on to study with Bill Farrand and Donald Eschmann at the University of Michigan. Caroline Malone worked at Fengate under the inspired guidance of Francis Pryor, where Charly French also undertook his early geoarchaeological work. They both collaborated in their first major project in the 1980s with Edoardo Biondi, Graeme Barker, Mauro Coltorti, Rupert Housley, Chris Hunt, Jan Sevink (and his pupils Peter Finke and Rene Fewuster) in the regional study of Gubbio. It was, though, the later study of the uplands of Troina at the turn of the millennium in Sicily with Charly French and Gianna Ayala that opened their eyes to new ways of understanding geoarchaeology. This led to the in-depth collaboration with Charly on the island of Malta, entitled FRAGSUS (PI Caroline Malone), which substantially interrogated the rationale for the stability and fragility of the ecology of the Maltese temples. The collaboration lives on through the prospect of continuing work with Charly's pupils, notably Federica Sulas, Gianbattista Marras, Petros Chatzimpaloglou, and Sean Taylor. Caroline Malone is a professor emerita of prehistory at Queen's University Belfast and Simon Stoddart is professor of prehistory at the University of Cambridge.

Fraser Sturt
Southampton Marine and Maritime Institute,
University of Southampton, Avenue Campus,
Southampton SO17 1BF, UK
Email: F.Sturt@soton.ac.uk
Fraser is a prehistorian and marine geoarchaeologist who focuses on the Mesolithic/Neolithic transition in submerged, coastal and island contexts.

Federica Sulas
Charles McBurney Laboratory for Geoarchaeology,
Department of Archaeology, Downing Street,
Cambridge CB2 3DZ, UK
Email: fs286@cam.ac.uk
Federica (PhD 2010, Cantab.) is a senior research associate at the McDonald Institute for Archaeological Research, University of Cambridge. Her research interests include geoarchaeology and landscape historical ecology.

Magdolna Vicze
Matrica Museum and Archaeological Park, 2440
Százhalombatta, Gesztenyés út 1–3, Hungary
Email: vicze@matricamuzeum.hu
Magdolna (PhD) is an archaeologist with primary interests in household archaeology. She is working in the National Institute of Archaeology of the Hungarian National Museum as a Bronze Age researcher and is the leader of the SAX Project (Százhalombatta Archaeological Expedition). The archaeological expedition at Százhalombatta is a long-term international research program with the aim of studying the life and daily activities of prehistoric people at a Bronze Age tell settlement. Her other interest is in mortuary practices.

Figures

Tables

Chapter 3

Landscapes of scale or scales of landscape: patterns of land use and landscape

Michael J. Allen

The presentation and interpretation of geoarchaeological, and often environmental archaeological, work can be difficult to assimilate and comprehend by others outside that field of expertise, and more importantly by the archaeological audience with whom we should always be engaging. While clear and unambiguous narrative always helps, this paper illustrates the value of committing land-use reconstructions to maps, where a geoarchaeological and environmental team cannot hide. This requires land use to be defined, and that ambiguous locational descriptions be replaced by clearly mapped and defined areas. Importantly, it requires much greater engagement, interpretation and reconstruction. Assumptions need to be made explicit and a number of land-use parcels clearly defined, and then mapped. This in itself is an important valuable learning and research process omitted from many projects. Although this clearly exposes the team to criticism and critique, it is testable – the addition of new results enables models to be modified and revised in a dynamic and iterative process. This paper takes the reader through this journey.

Geoarchaeological investigation often includes fieldwork (augering and test-pitting) beyond the confines of the 'excavation' (aka 'the landscape') to map the current soils and sediments (cf. French *et al.* 2007, fig. 2.2). These sequences are often the basis for environmental archaeologists and geoarchaeologists to provide data and interpretations that look beyond the confines of the 'site'. These data are the ideal basis to reconstruct *patterns* or distributions of land-use (i.e. human activity) over a study area (e.g. Smith 1984; Allen *et al.* 1990, fig. 155; Allen 1997a, pls 1–5; Allen 1997b, fig. 120; Gillings *et al*. 2008, figs 5.5–5.12; see Table 3.1). These graphic reconstructions are invaluable, but perhaps have not been attempted as widely as they could. This paper indicates some of the potential difficulties, but more importantly illustrates the potential gains in both academic, and public, comprehension. This paper follows similar lines to Allen (2000) but takes onboard to a much greater extent the role of soils, sediments and geoarchaeological aspects which it largely neglected, and re-examines some of the baseline assumptions used in previous reconstructions.

Environmental archaeologists and geoarchaeologists have become increasingly good at examining the environment of the past, especially from sites and single loci within a defined landscape. Interpretation has often been increasingly high-definition and sophisticated, but often driven by defining 'place', and a long time-trajectory of change. In many ways this still harks back to pollen diagrams with long records of climate and vegetation change (cf., Godwin 1940; 1956), and to land snail histograms of deeply stratified sediments and long environmental histories (e.g. Brook and Devil's Kneadingtrough, both in Kent, England; Kerney *et al.* 1964).

Interpretation needs to develop away from a one-dimensional narrative-driven interpretation or reconstruction of the environment of a place over time, and illustrations need to examine the *pattern* of the environmental landscape mosaic and land-use over space and time. For decades archaeologists have commonly plotted the development of monumental and site histories over landscapes. When they have realized the biases in a monument and site-based interpretation, they have filled in the blanks with data from large fieldwalking campaigns of areas between the sites, such as that at Stonehenge in the 1980s (Richards 1990), and on Bullock Down on the South Downs and Beachy Head near Eastbourne, England, in the 1970s (Drewett 1982), or geophysics, aerial reconnaissance, LiDAR, etc. Environmental archaeologists are, in particular, adept at obtaining and utilizing offsite data to obtain wider landscape interpretation, rather than site-specific and human-activity biased interpretations from site.

Land-use patterns (a proxy for human activity)

Often, project reconstructions are based on a single pollen diagram and palynological narrative, or on a few site-based land snail histograms, from which a two-dimensional transect of the landscape is typically represented with vegetation defined by topographic zones (Fig. 3.1; see also e.g. Bell 1981, fig. 5.1; Bell & Walker 2005, fig. 7.1). The result is, however, a schematic figure and conceptual reconstruction narrative, which is geographically generic and not location- or point-specific. Attempts to look at landscape dynamics in a more three-dimensional view are often too location-specific, cover too small an area, or are conceptually based (Fig. 3.2). Even when several key pollen diagrams are obtained from a single project they are often used in a confirmatory manner, rather than to significantly advance spatial patterning of vegetation to accompany the vegetation history.

To really move forward we need to attempt, however difficult, to create testable patterns of land use with which to assist in interpreting human activity and use of landscape over time. This should include both offsite and onsite data, but more importantly it requires

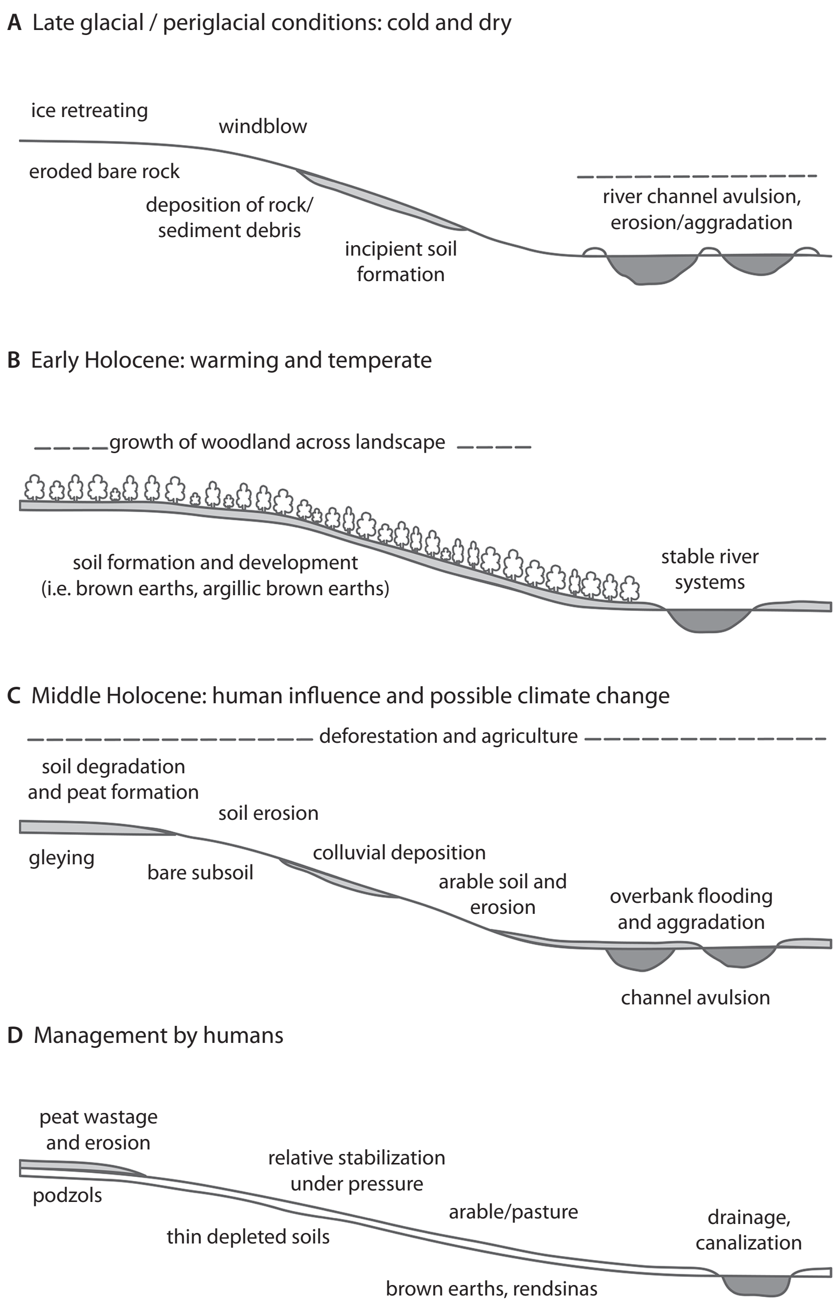


Figure 3.1. *Schematic palaeo-catena model for the development of soils of southern England from French (2015, fig. 23). Image: Charles French.*

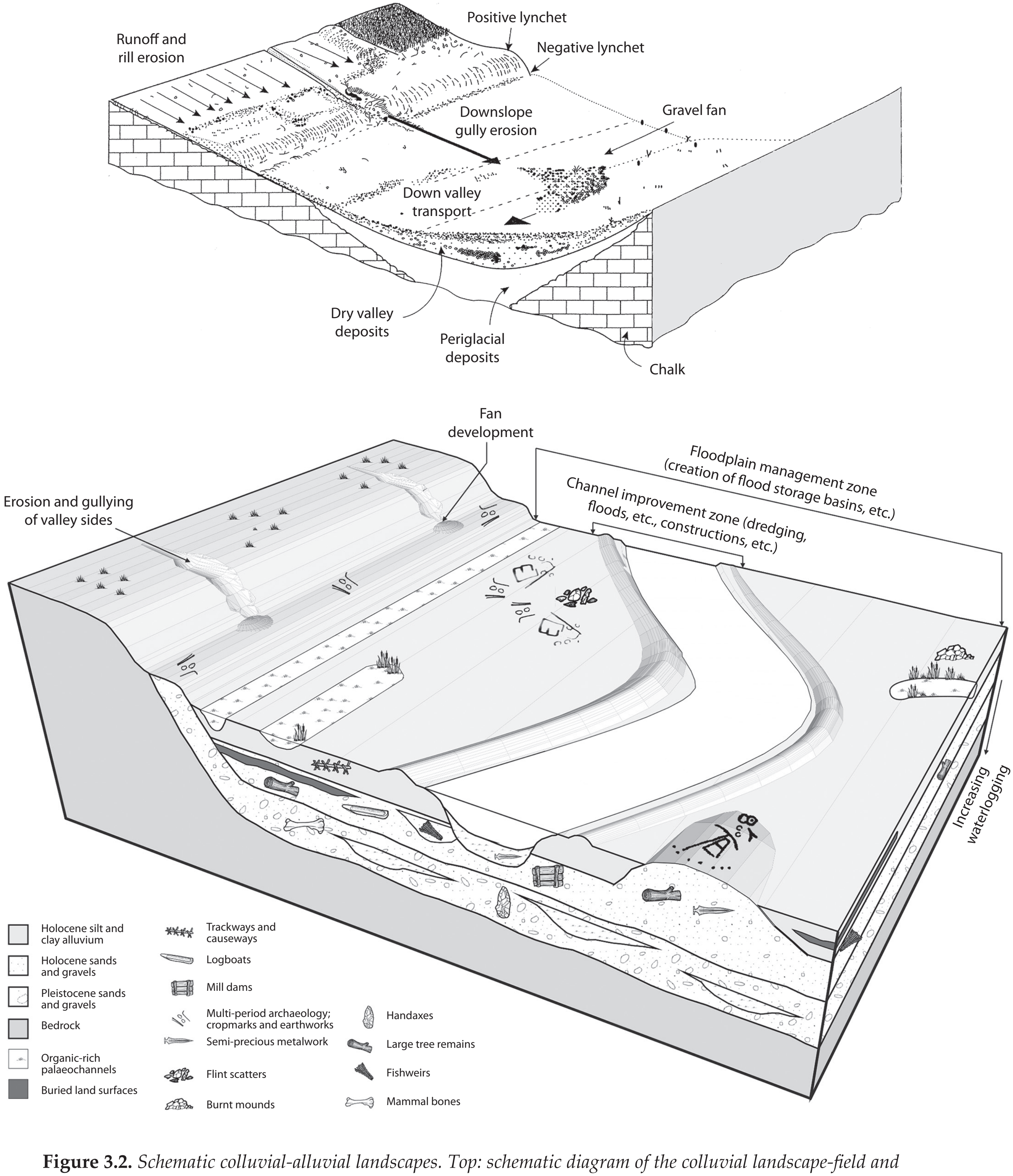


Figure 3.2. *Schematic colluvial-alluvial landscapes. Top: schematic diagram of the colluvial landscape-field and valley erosion (French 2015, fig. 6, after Allen 1988a, fig. 6.5; 1991, fig. 5.2); bottom: schematic diagram of an alluvial landscape (French 2015, fig. 7, by D. Redhouse, adapted from Brown 1997, fig. 1.1).*

multiple data sets within the defined project landscape (Allen 2000). Where previously one or two long pollen diagrams have provided a useful time-transgressive history, in order to look at this over space and place multiple data sets are required, including representative portions of each topographic, pedogenic, sedimentological and hydrological zone, and encompassing any defined archaeological zones or divisions. Only when this is achieved can we even consider the generation of useful maps and visualization of patterns of land-use.

Mapping patterns of land use

Archaeologists regularly visualize and interrogate time-specific data by mapping the *distribution* of the occurrences of different data sets (artefact types, site, or monument types), the combination of which gives a sense of the use of the landscape, and of the actions of past communities within that landscape. In environmental archaeological terms, achieving something similar is more difficult because we do not wish to map the presence or occurrence of data (which might reflect preservation bias or fieldwork limitations). Instead, I wish to record or map the *interpretation* of a set of palaeoenvironmental data, or multiple sets of different proxy data, over the landscape. Palaeoenvironmental landscape reconstruction requires, therefore, a series of stages before any land-use distributions can be mapped. This has only recently been potentially achievable for a relatively small number of landscapes where a large number of proxy datasets have been acquired across a project study area. Examples from the U.K. include the Allen Valley, Cranborne Chase, Dorset (French *et al.* 2007), Dorchester, Dorset (Allen 1997b), Stonehenge, Wiltshire (Allen 1997a), and ongoing work (with Charly French) in the Avebury environs in the AHRC-funded projects 'Between the Monuments and Living with Landscapes', led by Josh Pollard and Mark Gillings and colleagues.

It is relatively easy to provide a narrative of land-use and landscape change as this is only abstract, and although it provides an excellent picture it is, unlike much of the combined archaeological monument, site and artefact distributions, not ground-located, nor landscape or point specific. In the past, however, environmental archaeologists have fought shy of placing interpretations of vegetation type and land use over specific project geographies. This involves combining scientifically obtained data (in various forms) and interpreting this in terms of a series of individual ecologies or land-use practices, and then placing and stretching them over a real landscape in what may be seen as an unscientific manner. This paper will show that if used with rigour and exactitude this is far from that. Moreover, this may include computer-generated modelling of ecosystem behaviour (Ludeke *et al.* 1999; Ares *et al.* 2003) and palaeoecology (Heiri *et al.* 2006; Samarasundera 2007).

One of the difficulties of creating a visualized prehistoric landscape reconstruction, rather than an 'artist's impression', is that it needs to be based on data which themselves are spatially and temporarily restricted, often derived from excavated sites (single points) with samples representing limited chronologies. Interpretation has to be stretched over huge spatial and temporal gaps in these imagined landscapes, a process many archaeologists have felt uncomfortable with. Other ways of presenting prehistoric land use and landscape other than maps include via describing the journey of an alter ego through that prehistoric landscape (cf. Allen 2002 and see below).

The land-use or environment maps described below are principally derived from land snail and pollen data, in the first instance used to define the main vegetation and land-use type. Land snails provide an excellent indication of the vegetation character at a local scale (Allen 2017a, and fig. 1.1), while pollen provides the vegetation ecology and species composition, and a wider picture of the vegetation cover (Dimbleby 1985). Information from charred plant remains, wood charcoal and animal bones, when available, provides a flavour of the environment, land-use, and other human activities. These palaeoenvironmental datasets are, however, often derived from archaeological 'sites' which are themselves the focus of prehistoric activity. Consequently, the interpretation of the local environment may be biased towards that created by human activities, and reflect less the wider more generic local landscape. The methods and processes employed in interrogating the data and creating these maps are described by Smith (1984) and Allen (1997a; 2000).

Geoarchaeology has, encouragingly, made an increasing impact upon and contribution to archaeology in the last forty years (Butzer 1982; Courty *et al.* 1989; French 2003; 2015; Goldberg & Macphail 2006; Macphail & Goldberg 2018a), and one way for further integration and improvement is to use a combination of proxy environmental data (e.g. pollen, land snails) and underpin and unite these interpretations through geoarchaeology, i.e. the distribution and character of soils and sediments together with information from buried soils. The integration of snails, pollen and other environmental information provides site-based, and at best local land-use environments within a broader/wider palaeoenvironmental background. One clear way of linking these datasets and underpinning local interpretations is the unification and mapping of the soils and sediments across a whole study area (Fig. 3.3), i.e. defining and characterizing land-use packets/

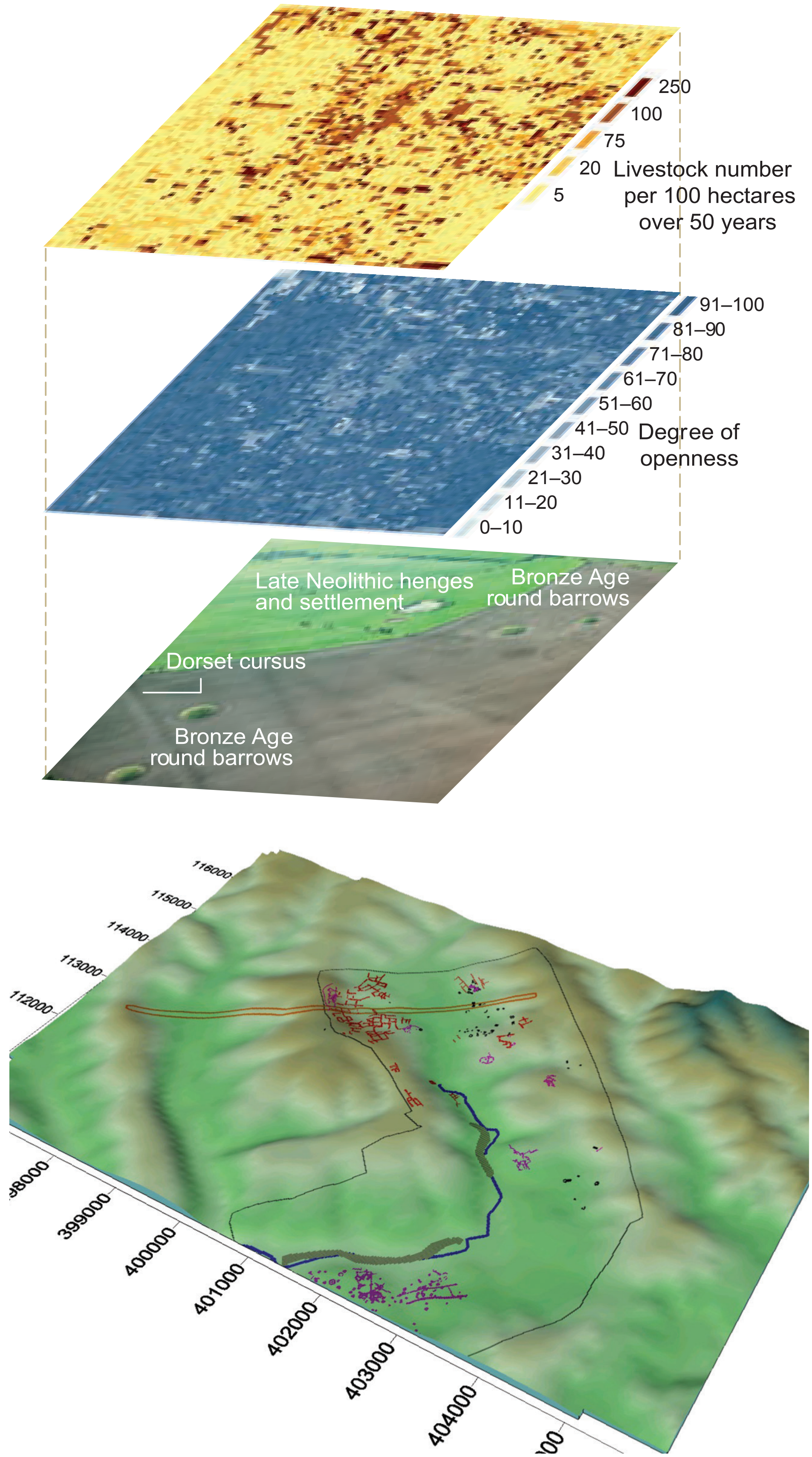


Figure 3.3. *a) Dynamic archaeological-palaeoenvironmental GIS-based simulation model: lower aerial view of Wyke Down, Cranborne Chase, overlain by model of earlier Neolithic openness, and superimposed with model of associated grazing intensity (French 2015, fig. 20, by D. Redhouse after Samarasundera 2007); b) A digital elevation, or terrain, model (DTM), of the prehistoric sites in the upper Allen value of Cranborne Chase, Dorset (French 2015, fig 11, by C. Begg).*

packages (*sensu* Needham & Macklin 1992), combined with a deep geoarchaeological understanding of the soil and sediment history. The latter requires identification of archaeological soil or sediment parcels or packets placed within a map of the modern soils and deposits as a proxy for past environments and environmental histories. Overall, this more geoarchaeological approach mitigates/minimizes some of the pitfalls of limited data sets in large areas (Allen 1997a, table 2; 2000, table 2.2; 2005, table 7.3). More recently, reconstruction, interpretations, and current projects (e.g. Avebury environs 'Between the Monuments and Living with Monuments' projects – works in progress) have included more information from geoarchaeology (presence and type of soils and sediments, and data from soil micromorphology).

Providing a land-use map and plotting the *patterns* of land-use require an exponentially larger number of datasets from within each chosen timeframe, and an in-depth comprehension of the whole project landscape at the ground level, i.e. for the project team to have walked a large portion of and visited most of the areas within each project landscape. Beyond that, it requires weaker interpretation, or even imagination or guesswork in the areas where data are limited – and this is where many archaeological scientists find a loss of 'scientific rigour' worrying, and retreat to the safety of computer assistance. Land-use modelling often then fails due to lack of data, resulting in low density of the spatial and temporal information in relation to the size, geography and topography of the landscape. Areas of limited evidence, or guesswork, are less problematic if they are made overtly explicit rather than unacknowledged.

These reconstructions allow much greater engagement with archaeological audiences at an academic and interpretational level, as well as with the general public at a broader educational level. Without environmental archaeologists' direct input, we are often left with generalized artists' impressions, which tend to be based on general notions rather than real data, and other archaeologists' uninformed interpretation of our data, rather than developing these in a better and more nuanced way ourselves, or better still, in collaboration. The strength of such reconstructions is that they provide maps that can subsequently be checked and modified with the emergence of new datasets. Data-poor areas can be specifically targeted for fieldwork, and in these ways the maps are iterative and directly inform future fieldwork.

Normally the interpretational development would be progressive and successional – the framework being set, and the interpretations and reconstructions being tweaked, modified and developed with each new raft of archaeological and analytical (palaeoenvironmental or geoarchaeological) data obtained. Greater improvement would be expected especially in areas or for periods where the data are limited or poorly understood. We would hope that these are precisely the areas (geographic, chronological or thematic) which are being targeted by new fieldwork and research.

Patterns of land use

One of the first really successful examples of analytically mapping prehistoric vegetation and land-use patterns in Europe was Smith's series of pen and ink reconstructions of the early, mid- and late Neolithic of the Avebury area in England, which were based on the careful, elegant and critical assessment of the snails, pollen and faunal data, and three accompanying maps summarizing the data (Smith 1984, figs 2, 3, 8–10; Smith 1985, 44–52), combined with the record of archaeological monuments. Together these provided the basis for both land-use interpretation and for mapping of location and extent of its component mosaic (see Allen 2000; 2005).

Smith's maps (Fig. 3.4) of the early and late Neolithic offer a land-use reconstruction of the extent and pattern of land-use through the entire depicted landscape (*c.* 35 sq. km), as well as change through time. The areas of different land-use were extended well beyond the location of the datasets, nevertheless they provide a pleasing and analytically derived holistic landscape map. It is perhaps worth noting that Smith had an interest in environmental archaeology, but was not an environmental archaeologist himself, and perhaps that is why he was able to think outside the box and the traditional diagrammatic ways of presenting environmental information. These illustrations had a profound influence on my own approaches to creating land-use maps for both the Dorchester and Stonehenge areas in England.

Maps of the prehistoric land-use for the Dorchester area in Dorset (Fig. 3.5) were soundly based on environmental data (principally land snails) from the research excavations at Mount Pleasant (Wainwright 1979) and Maiden Castle (Sharples 1991), and commercial archaeological investigations at Greyhound Yard (Allen 1993; Woodward *et al.* 1993), Alington Avenue (Allen 2002; Davies *et al.* 2002), and along the Dorchester southern by-pass and western link (Allen 1988b; 1997b; Smith *et al.* 1997). The individual environmental interpretations for each site (derived from the proxy dataset/s) were defined and characterized in terms of vegetation type and land-use character and plotted to obtain a 'flavour' of the distribution and pattern of the different environments. Strongly influenced by Evans' concern about extending land-use interpretation over

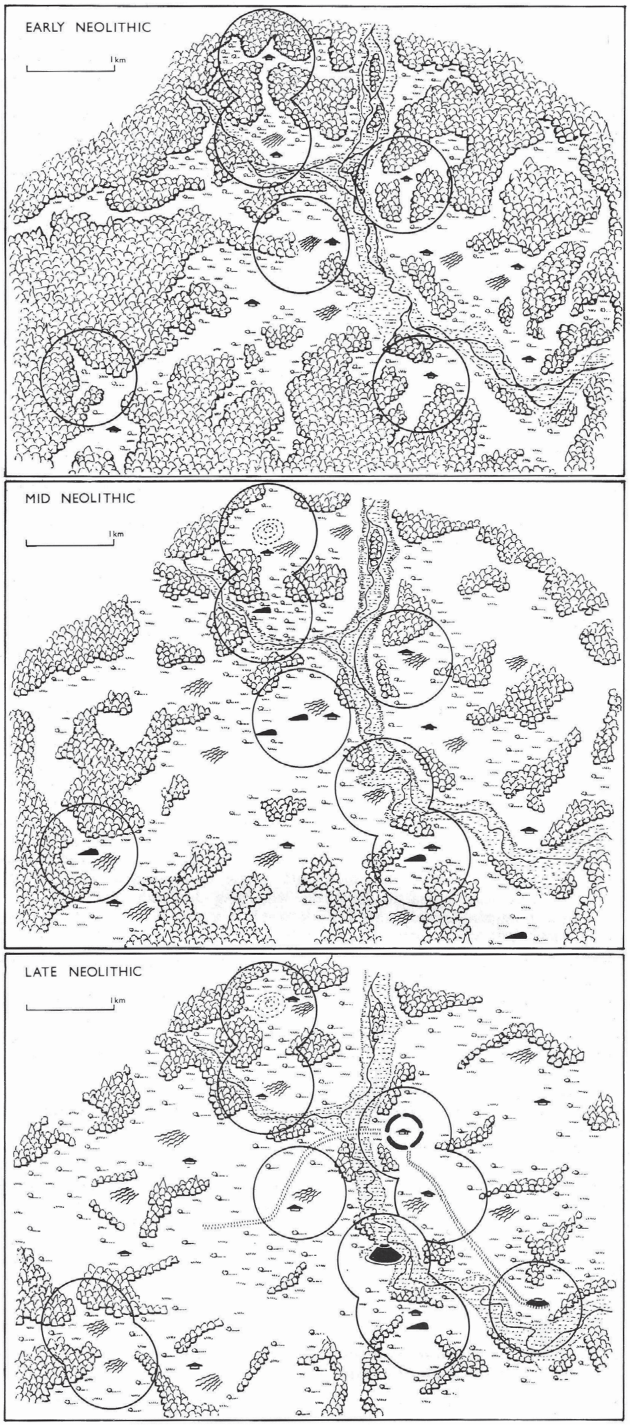


Figure 3.4. *Smith's environmental reconstructions of the Avebury landscape (Smith 1984). Images reproduced with permission of the Prehistoric Society.*

the whole landscape window as Smith had done, the reconstructions for the Dorchester area (initially presented in 1988), were more conservative. Two maps were generated: one for the mid-Neolithic and the other representing the late Neolithic/early Bronze Age, in line with the focus of many of the excavated sites. Interpretation of land-use and environment only extended over the areas from which data had been obtained (Allen 1988b).

Large areas of the landscape window were left unmapped, resisting the temptation to fill in the rest of the map, and keyed as 'no data', leaving the reader to guess (Fig. 3.5; Allen 1997b, fig. 120). Subsequently, working at the end of the 'Stonehenge Environs Project', and just before completion of the polished volume, there was an opportunity to review the environmental data from the project (Richards 1990). This was undertaken explicitly following Smith's critical approach (1984; and pers. comm.) but employing a slightly more relaxed conservative approach than for the Dorchester environs. Four maps were generated (Fig. 3.6) reflecting the same periods used in Cleal's (1990) summary of the pottery sequence over the landscape, and used by Richards (1990) for his review of the entire project. The environmental data from each site, and the presence of a significant archaeological monument or group of monuments, were considered to reflect the area surrounding and beyond them. Throwing caution to the wind, the palaeo-environment was extended for half a kilometre around each significant site, making a one kilometre environmental 'bubble' around each set of environmental data.

Palaeo-environments were then also inferred around each significant archaeological monument (as they had been for the Dorchester environs). Although excited by the first environmental reconstruction based on data rather than informed archaeological supposition, and in spite of the 1 km environmental bubbles, the resultant maps still looked blank and echoed the problems/weakness of those from the Dorchester environs. Although the Dorchester (Allen 1997b) and Stonehenge environs (Allen *et al*. 1990) maps presented environmental interpretation over only the parts of the landscape from which data were obtained, the honest 'blanks' unfortunately effectively looked like open areas of cleared woodland, where in reality at the time it was thought they represented the opposite: dense woodland with little archaeological activity and thus little archaeological and palaeoenvironmental evidence. Consequently, one has to question the value of these to (successfully) communicate land-use patterns and changes. Although critical of Smith stretching the extent of his environmental reconstruction beyond the limits of his data, his illustrations are bold, archaeologically more useful, and are ultimately spatially testable.

Surprisingly, although the large 'Stonehenge in its Landscape' project provided some key datasets (especially the Mesolithic post pits), my environmental

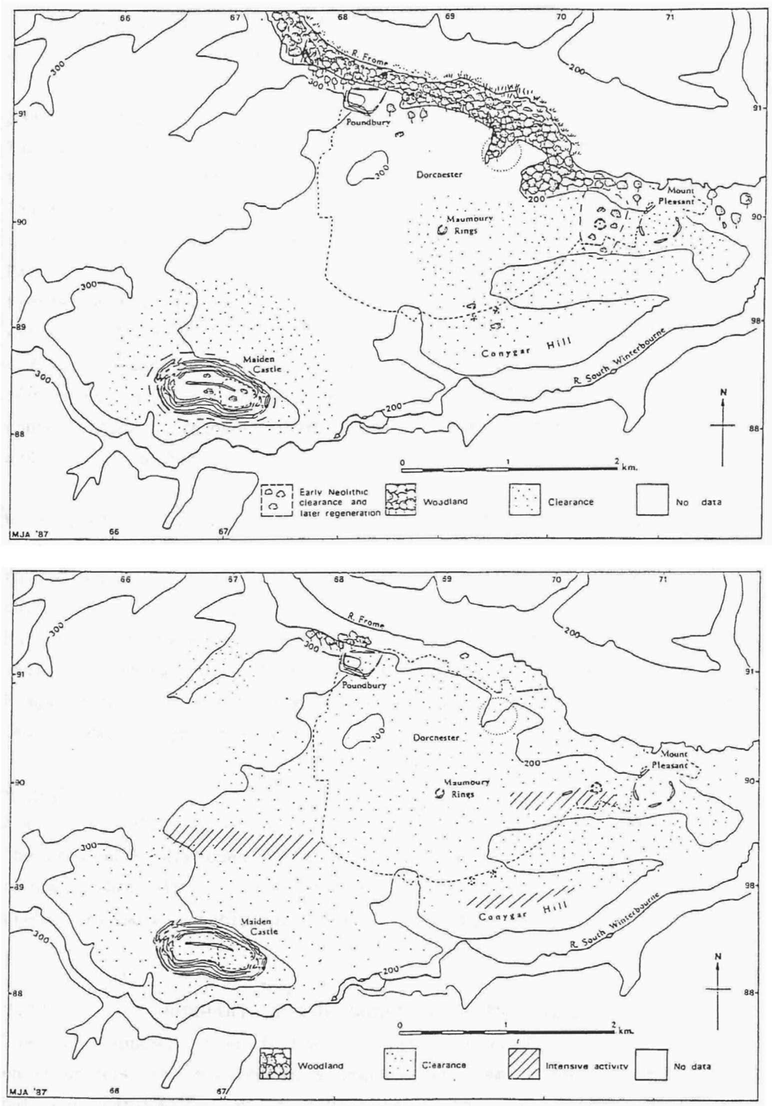


Figure 3.5. *1988 land-use reconstruction for the Dorchester environs (Allen 1994; fig. 98; 1997b, fig. 120). Images: Mike Allen.*

discussion was restricted to text narrative (Allen 1995a,b). An opportunity to provide new palaeoenvironmental maps of the land-use and revise those produced for the preceding 1990s 'Stonehenge Environs Project' (Richards 1990) did not form part of the project design, as it was principally centred around the publication of previous twentieth-century, largely unpublished, excavations of the monument and associated adjacent monuments. Nevertheless, the Royal Society and British Academy hosted a two-day conference to celebrate the completion of this 'definitive publication' (Cunliffe & Renfrew 1997). That enabled the publication of additional, personal research together with a review of the important Mesolithic (and other) data. The opportunity was taken to create what were then much more sophisticated illustrations of the land-use patterns, to assist our comprehension of the use of the whole landscape.

It was realized that the reconstructions from the Dorchester and Stonehenge environs were academically and ethically strong. Interpretation was constrained to specific areas from which the data were obtained and to the immediately adjacent, and probably over-exaggerated 'bubbles', to which the data were considered to refer. However, as we have seen, the resultant 'truthful' images were not as informative as initially perceived. To overcome the 'blankness' of the 1988 Dorchester and 1990 Stonehenge reconstruction maps, and to provide a more holistic reconstruction for the Stonehenge landscape, the interpretational envelopes for each vegetation type were stretched (Fig. 3.7). Their extent was moderated principally by using geographical parameters (topography and hydrology) in a digital terrain model (DTM), combined with the distribution of both archaeological sites and artefact scatters. These parameters allow a more nuanced

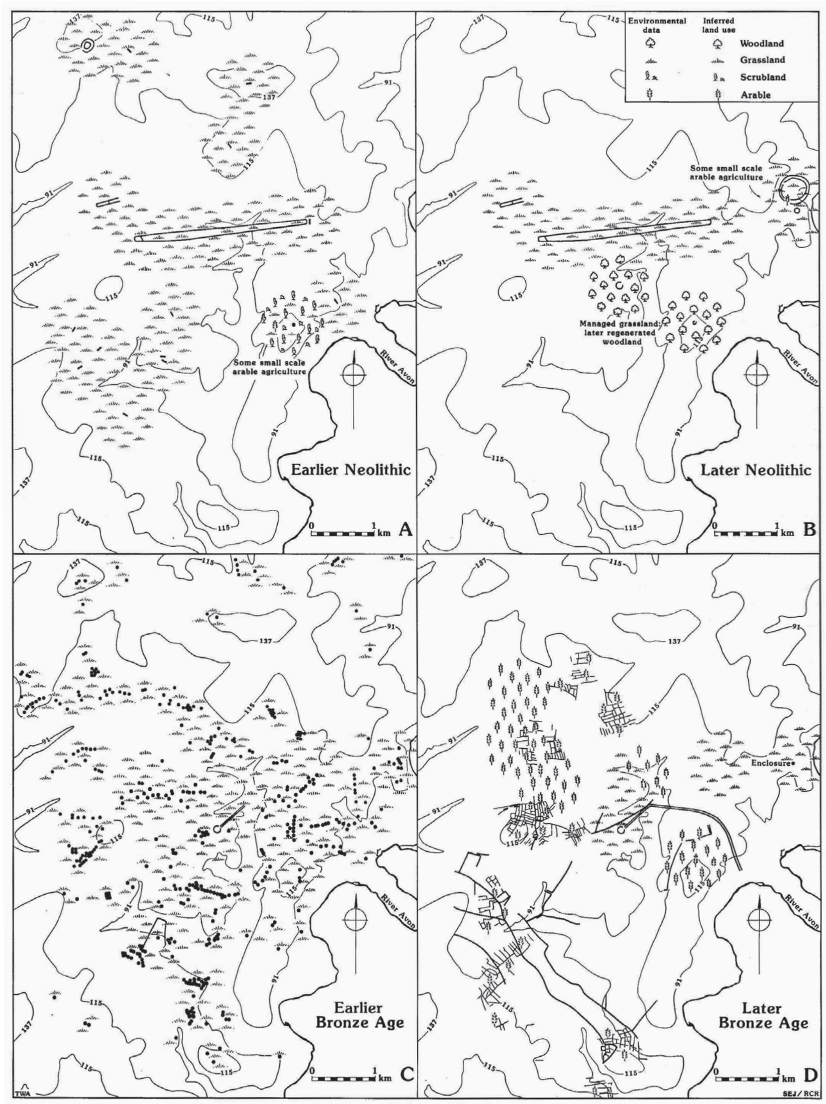


Figure 3.6. *The 1990 changing prehistoric landscape from the 'Stonehenge Environs Project' from Richards (1990, fig. 155). Images reproduced with permission from Historic England.*

'stretching' of the environmental land-use interpretations, to cover the entire block of land with the map.

It was possible to identify five crude and relatively general land-use categories from the palaeoenvironmental data: i) oak, hazel, elm woodland, ii) secondary open woodland, iii) floodplain, iv) grazed grass, and v) arable plot. The land-use 'envelopes' (parcels of land with the same land-use characteristics; Allen 2000) were centred on the data, and manually draped over a DTM, creating an environmental reconstruction of the land use for the entire mapped area. The shape and extent of these envelopes were manually modified and manipulated in light of the environmental and archaeological data (collated, respectively, by myself and Ros Cleal), using the topography provided by the DTM, and the distribution of archaeological monuments, sites and artefact scatters as guides. More detailed description of this process is in Allen (1997a; 2000). This process was essentially a slightly more informed and rigorous version of that used by Smith (1984; 1985) for Avebury. The maps were divided into pixels, and site and near-site archaeological and environmental data, and land-use interpretation listed for each. The level of confidence in that land-use ascription, on a scale of 1–10, was recorded against the pixel data. In so doing, the interpretations were rigorous, justified and quantified, the ideal basis on which to enter into an interactive GIS and for remodelling in the future.

Returning to Avebury, my 2005 review of the Avebury area (Allen 2005), although lacking new illustrative suggestions of the land-use, did publish three environmental maps by Smith (1984), and reproduced four extant artist's reconstructions by Jane Brayne, which provided the then new consideration of the changing land-use patterns (Fig. 3.8). Finally, as a result of the 'Landscape of the Megaliths' project,

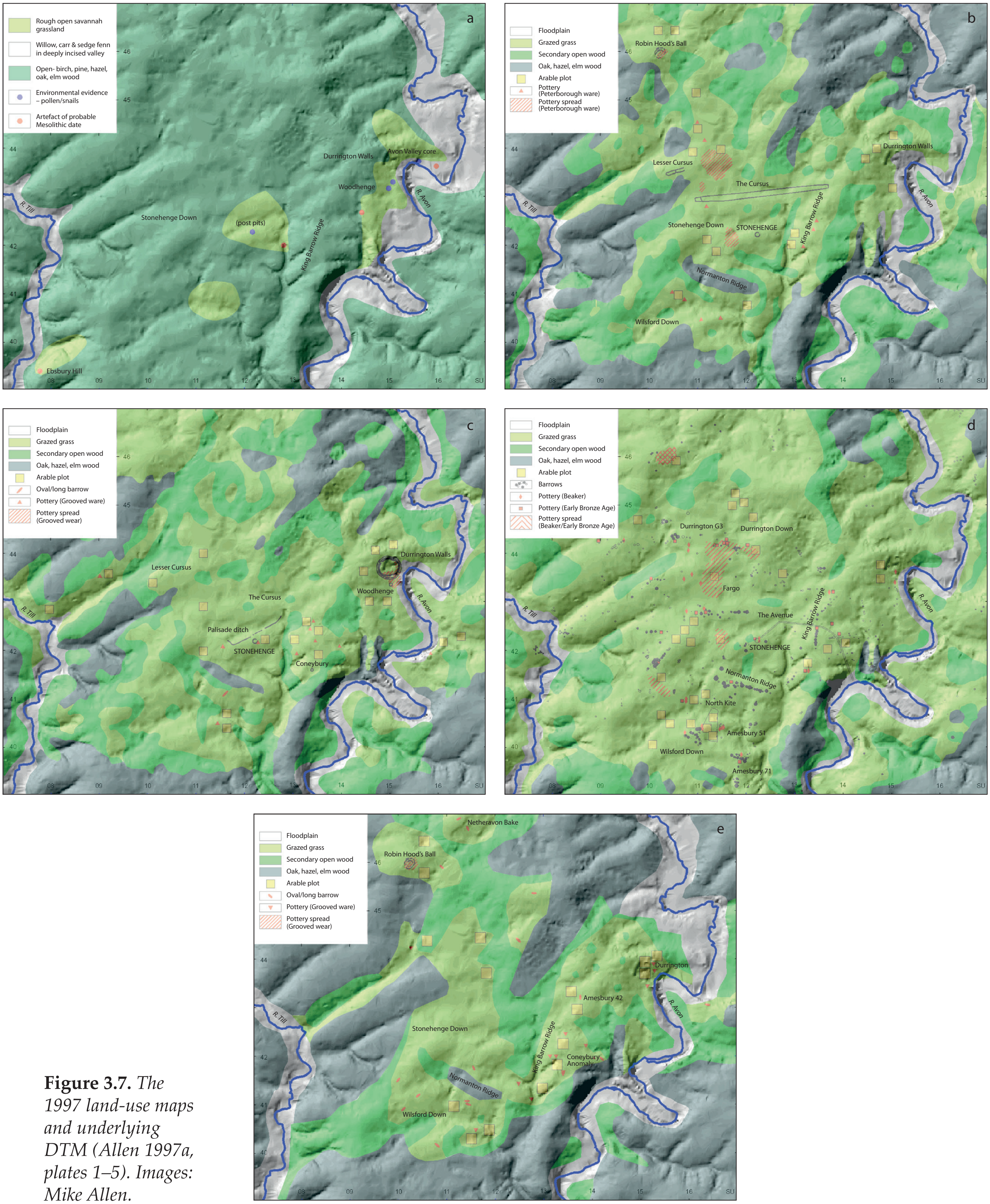


Figure 3.7. *The 1997 land-use maps and underlying DTM (Allen 1997a, plates 1–5). Images: Mike Allen.*

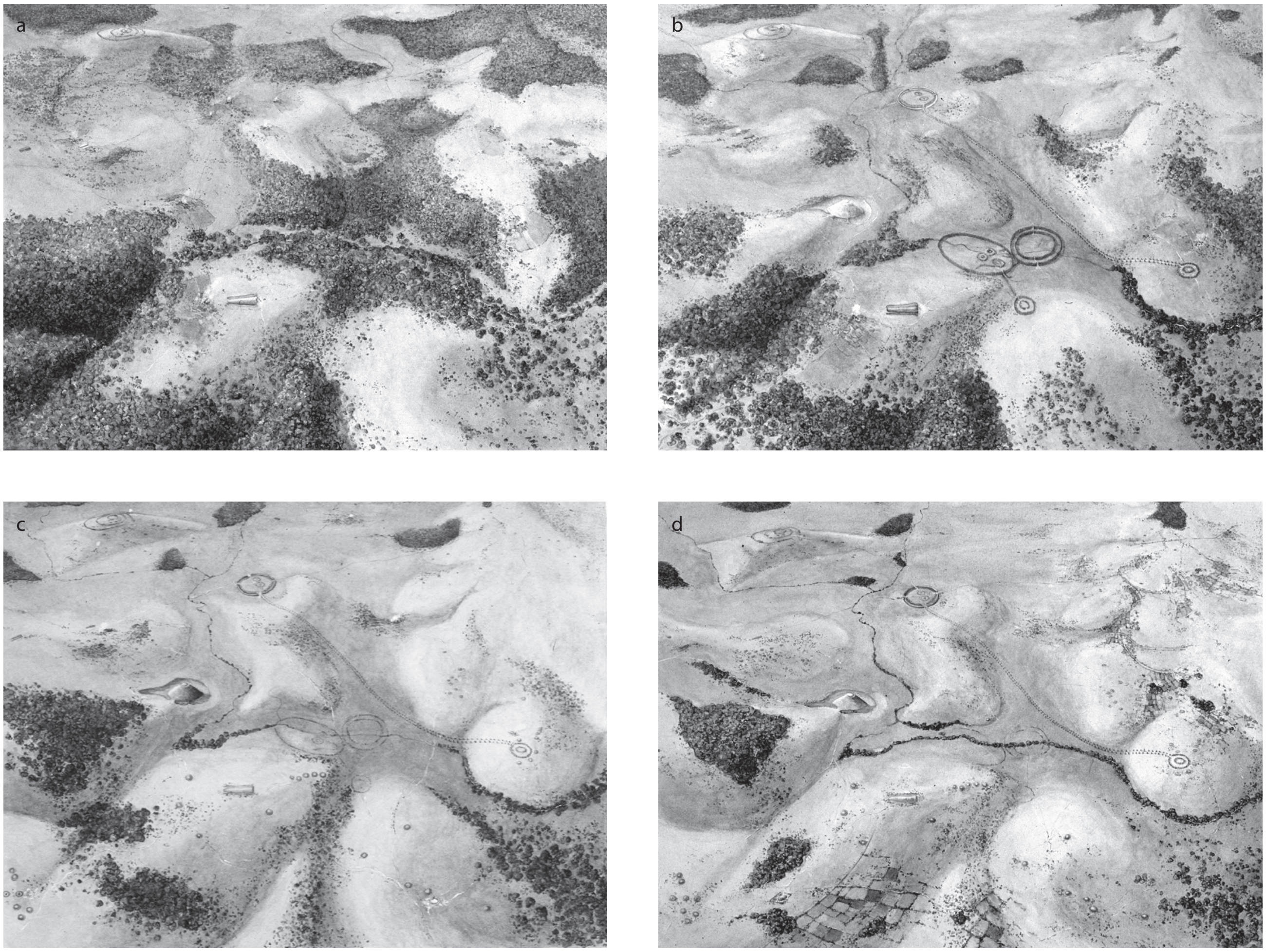


Figure 3.8. *Reconstruction of the Avebury landscape: a) mid-Neolithic* c. *3400* BC*, b) final Neolithic* c. *2200* BC*, c) Early Bronze Age* c. *1700–1600, and d) mature Bronze Age* c. *1000* BC*. Images: Jane Brayne.*

Gillings *et al.* (2008, figs 5.4–5.15) produced nine masterful, detailed and critiqued reconstructions of the Avebury landscape from the pre-Neolithic to the late Bronze Age, derived conceptually in a similar way to those described above, but they were significantly more sophisticated. The data were held within a GIS to assist manipulation, interrogation, output and visualization, and, importantly, included much stronger plant community associations. This enabled them to subdivide the generic 'woodland' label into four separate ecologies, and the floodplain into two (Table 3.1). As advocated strongly for earlier reconstructions, these are 'accurately georeferenced and highly structured' (Gillings *et al.* 2008, 174, table 5.3), and directly based on the palaeoenvironmental, archaeological and geographical data.

These reconstructions can inform both the academic and general public, as seen in the Stonehenge interpretation diorama in the new visitor centre opened in 2013. Unfortunately, just as the long-awaited video (based on my interpretations and advice) was being completed, I realized that we needed to re-think and restart the whole thing from scratch (see below). Although not possible then, this is something that should remain high on the agenda, even though it is more difficult to explain that most of the prehistoric landscape was enveloped in a woodland of some kind before being cleared for living, pasture, and monument building.

An excursion

Land-use reconstruction images are generated to assist in understanding people in the past and how and where communities lived and operated in the landscape: What was the landscape like? How did they modify and utilize that landscape? Was it changed though definite constructs, or inadvertently by everyday activity? A graphical representation clearly brings

Table 3.1. *Number of maps and vegetation/land-use categories deployed in the various environmental reconstructions discussed.*

Avebury	Dorchester	Stonehenge	Stonehenge	Avebury
Smith 1984	Allen 1988b; 1997	Allen *et al.* 1990	Allen 1997a	Gillings *et al.* 2008
2 maps Early Neolithic–Late Neolithic	2 maps Early Neolithic–Late Bronze Age	4 maps Early Neolithic–Later Bronze Age	5 maps Mesolithic–Later Neolithic/Early Bronze Age	9 maps Pre-Neolithic–Late Bronze Age
Woodland	Woodland	Woodland	Woodland	Dense oak, elm woodland of clay with flints
				Thinner oak, elm woodland on steeper clay slopes
				Oak elm woodland on greensand and gaults
				Mixed oak elm woodland on chalk
	Secondary woodland	Scrubland	Secondary woodland	Secondary woodland
River margins			Floodplain	Low woodland and carr
				Woodland prone to flooding
General open grassland	Clearance, aka general open grassland	Grassland	Grazed grass	Cleared pasture and herbaceous scrub
Arable plot	Intensively farmed land	Arable	Arable plot	Cultivated plots

the archaeologist closer to the landscape, resources and processes of the past. But I was reminded that this is not the only way to 'get into' some of these past landscapes. If our palaeoenvironmental information is so good, and the archaeologist really understands the landscape, the geography and space, and empathizes with the place, it is possible to view that landscape in another way: one that is more difficult to share, but that helps refine and improve our interpretation. One way to test your own comprehension (strengths and weaknesses) of our reconstructions is to visually imagine the landscape as a reality; so real that you could walk through the imagined prehistoric landscape and describe it as you go. Not only is this self-informative, but areas that can and cannot be visualized and described well are the areas of strengths or weakness that require, if not attention, certainly recognition of their existence. One of the best studied areas, certainly in terms of size and data gain, is Cranborne Chase and the Allen Valley in England (Allen 1998; Allen & Green 1998; Green 2000; French *et al.* 2003; 2007). Ironically, although detailed soil mapping was undertaken in combination with palaeoenvironmental analysis, no full interpretive reconstruction map was produced. However, the landscape was visualized and described from the perspective of a middle Neolithic inhabitant of the landscape, 'Cranborne lady' (Allen 2002). Not only is the landscape described as viewed from the Gussage Down long barrow, but the reader is led on a journey which describes the countryside and vegetation, and they travel down the hillslope, across the Dorset Cursus monument into the Allen Valley and then up the northern valley side to Wimborne-up-Monkton, where the human remains of a middle Neolithic woman were found (Green 2000; Montgomery *et al.* 2000).

All change: a new geoarchaeology and palaeoenvironment to consider

The illustrations above and presented in Figs. 3.4–3.9, have largely been discussed through the philosophy and mechanics of their generation, rather than the interpretation or re-interpretation they bring to the landscape they describe. All of the above, from 1984 to 2008, were predicated upon the concept of pan-European post-glacial/early prehistoric vegetation succession and the development of a widespread mixed oak deciduous wood (Tansley 1939) by the mid-Holocene (early Neolithic in the U.K). This succession included human interaction, modification and ultimately domination. On this basis, mapping the land-use and vegetation history required the identification of localized and successive clearings leading during prehistory to the almost wholesale removal of the post-glacial woodland cover over large areas of the U.K. Reconstruction maps were largely based on mapping the removal of that woodland, and the progressive opening of the landscape. Many reconstruction maps, therefore, started with a full woodland cover, with patches being 'rubbed out' where archaeological sites were constructed and where woodland clearings were identified in the environmental data. The Avebury environmental maps by Smith (1984; Fig. 3.4), the artist reconstructions by Brayne (Fig. 3.8; Allen 2005, figs 7.3a,b, 7.4a,b), Gillings *et al.* (2008,

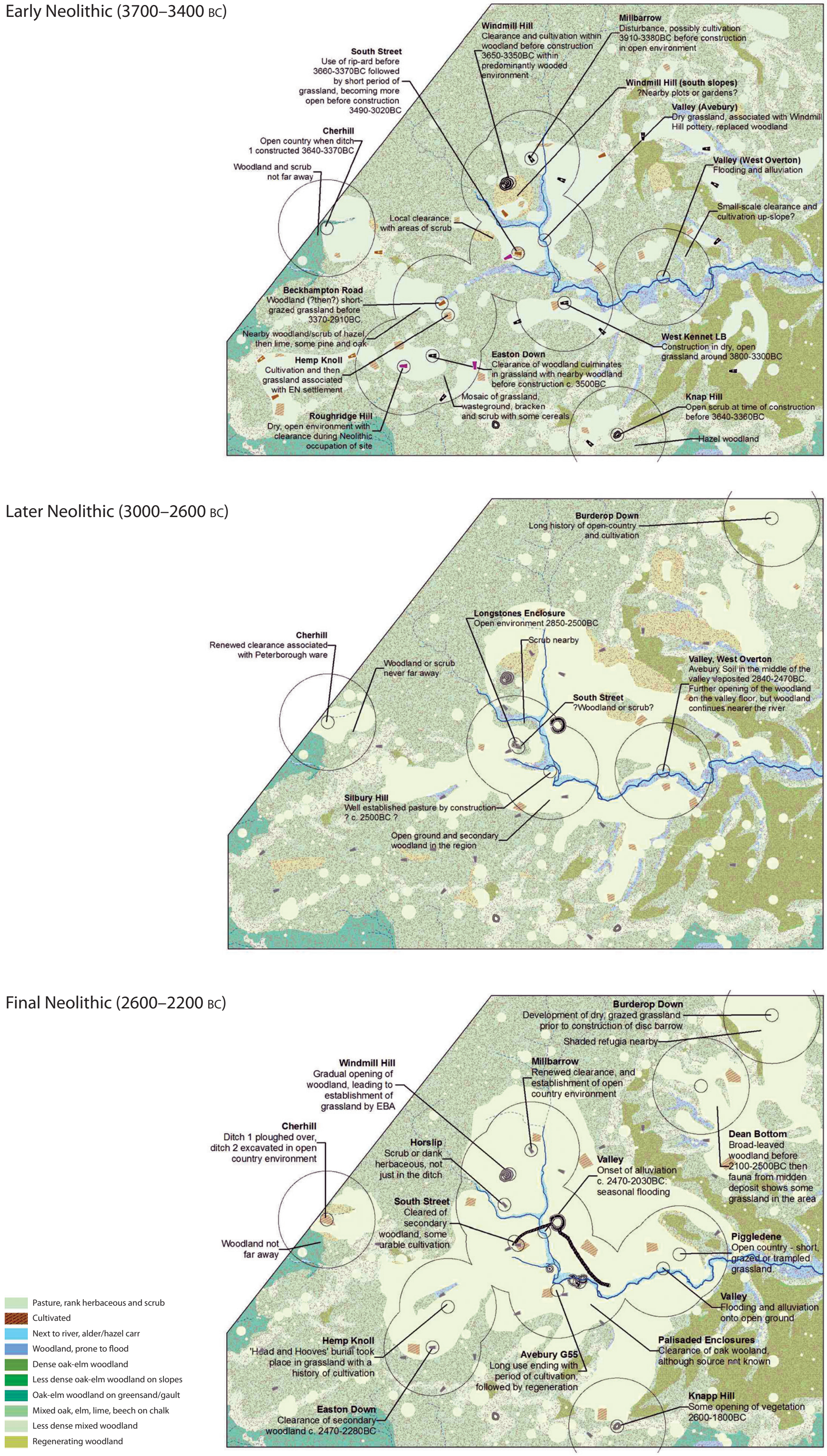


Figure 3.9. *Examples of the 2008 land-use reconstructions (Gillings* et al. *2008, figs 5.6, 5.8–5.9, 186–9). Images reproduced with permission from Gillings* et al. *and Oxbow Books (see also Acknowledgements).*

figs 5.4–5.12), and mine for Dorchester (Allen 1988b; 1997b) and Stonehenge (Allen *et al*. 1990; Allen 1997a) were all based on this premise. However, subsequent research in Cranborne Chase (French *et al.* 2007), the Stonehenge and Avebury areas (Allen & Gardiner 2009; Allen 2017b) and previous research around Dorchester (Allen 1997b) allows us to realize for the first time that the post-glacial woodland cover was not as complete, nor as widespread, as previously surmised. Neither Cranborne Chase nor Stonehenge was densely wooded (French *et al.* 2003; 2007; Allen & Gardiner 2009; Allen 2017b; and see Alexander *et al.* 2018). This has fundamental and profound implications for our interpretations of these prehistoric landscapes, but also for the understanding of the ecology of the British countryside (Alexander *et al.* 2018; see also Whitehouse & Smith 2010; Allen 2017b).

As a uniform continuous post-glacial woodland cover can no longer be assumed (see also Bell this volume), the premise of all previous palaeoenvironmental landscape and land-use maps is therefore false. New interpretations have to rely more on actual data points within the landscape, each with their own small geographical and variable chronological points of reference, rather than assuming a widespread woodland backdrop. This has huge and fundamental implications for environment and land-use reconstructions, and for our understanding of the communities who inhabited them (Allen & Gardiner 2009). Although full analysis of all the new data is not yet complete, we will be able to provide new general images/visualizations of the nature of the Stonehenge and Avebury landscapes, and, significantly, they will be (some of) the first to be based on the post-Tanseyan hypotheses presented by French *et al.* (2003; 2007) and Allen (2017b).

Conclusions: concepts and communicating patterns of land use

With the significantly increased level of analysis through space and time, as exemplified by Charly French's own work in collaboration with the author and other colleagues on Cranborne Chase, the Stonehenge Riverside Project, and at Avebury, what is now needed is a more concerted attempt to tentatively but assuredly apply science-based and more rigorous ecological modelling and interpretation of defined land-use 'packets' (as Gillings *et al.* 2008 attempted), and map these patterns over whole landscapes. Whilst we must admit that we have less confidence in the spatial distribution of extent of some land-use envelopes, this can be mitigated in part by palaeo-ecological modelling, a topic being investigated by a number of research projects (e.g. Caseldine *et al.* 2008; Bunting *et al.* 2013; 2016; 2018; Bunting & Farrell 2018; Farrell *et al.* 2020). Unless we take these bold steps, environmental archaeological interpretations of lived-in ancient, especially prehistoric, landscapes will be restricted to just more detailed but still two-dimensional abstract landscape interpretations, while our colleagues in other branches of archaeology look more clearly at patterns of occupation, settlement and activity in and across those landscapes.

Armed with these new data and interpretations, generated though a strong geoarchaeological approach with Charly French (French *et al.* 2003; 2007; Allen & Gardiner 2009), the concept of less wooded post-glacial environments is being extended into the Stonehenge landscape and the Avebury area (French *et al.* 2012; Allen 2017b). The new plank of interpretations for, in particular, the Avebury area will combine the archaeological and geoarchaeological information and manipulate it via GIS and realistic computer visualization models, to create a new generation and the next stage in visually interrogatable models. By using a gaming engine (Unity), a 3D reconstruction of the Avebury landscape can be built. This is undertaken in a traditional way, using GIS to map heights, soils and sediments, and builds on the approach used by Wheatley (in Gillings *et al.* 2008). This is augmented with extra data taken from augering, geophysics and excavations, to which any other information, such as land snail, soil micromorphology, palaeobotany, or faunal remains can be added, and provides a set of basic areas that we can overlay on the landscape and assign different biome identifiers. The 3D nature of the landscape is built using elevation data, which can be imported into the gaming engine and turned into 3D terrain in which we can walk. The properties of the different biomes are coded, including, e.g. 'grassland', 'woodland', 'riparian', etc. We can assign a specific suite of plants, groundcover, trees, creating the palaeo-ecology, with the animals and birds (even with their bird song), as informed by the GIS model. These data are taken by the gaming engine and overlaid on the 3D terrain, which effectively populates it with the right plants in the right places, as well as the hydrology and river levels, including 're-wetting' some valleys. It is then possible for the viewer to wander around a virtual landscape using either a VR headset or just a 'normal' computer game screen (Stu Eve, pers. comm.). As each of these biomes is dynamic and assigned a crude timescale, it is not only possible to walk through the virtual landscape, but to see the biomes change through the various defined phases … walking through time!

This will undoubtedly assist us in the new re-interpretation of the Avebury area in the first instance, and new palaeoenvironmental and geoarchaeological datasets will then be available for scholars to engage with both as information increases, and as the basis of interpretations changes again, as will the entire GIS and gaming model.

This paper is being written as visual computer-generated aids are increasing in complexity and ability at a pace, and becoming more widely available to the skilled, trained and untrained operator. Although this offers fantastic opportunities, we must also be wary and vigilant not to be fooled by visually impressive, beautifully rendered computer-generated images of the past, masquerading as 'reconstructions', rather than the 'operator's impression' that they are. What these computer-aided systems allow is the visual manipulation of the vegetation patterns, hydrology and water levels, and landscape views. As I complete this paper, we are just about to enter this world with the 'Living with Monuments' (Avebury) project where, using our new data, a new generation of maps, or worlds, will be generated.

Postscript

I have been lucky enough to work closely with Charly French on projects from Cambridgeshire to Dorset, encompassing Stonehenge and Avebury on the way. As these projects have been completed, and others approach their conclusion, it has been a great journey, and behind us we can see that excellent intuitive field geoarchaeology and concerted strong communal fieldwork, followed by in-depth analysis, have led to not just modification and improvement of old interpretations, but new ideas, new landscapes and new worlds, all led, imbued and encouraged by Charly. Perhaps in hindsight one of the failures or weaknesses of the Cranborne Chase project and publications was not to attempt to visualize or map the new and novel land-use reconstruction. This was not explicitly in our original research design; perhaps it should have been, but now the opportunity exists to go back to the data and revisit that world, virtually.

Acknowledgements

This paper, and my own environmental and geoarchaeological work and fieldwork has been strongly influenced by Charly for the past twenty-five years, during which time we have been colleagues, friends, teachers and students to each other – long may all of that last.

I would like to thank Martin Bell and Stu Eve for providing useful suggestions and information, and Julie Gardiner for discussing many aspects of the paper and assisting editing it into some sort of more logical shape. I thank Declan Ingram at Oxbow Books for finding and supplying digital images, and the following for permissions to reproduce figures: Historic England for permission to reproduce Figure 3.6, Josh Pollard, David Wheatley, Mark Gillings and Oxbow Books to reproduce Figure 3.9, the Prehistoric Society for permission to reproduce Figure 3.4, Jane Brayne for Figure 3.8, and finally thanks to Charly for unknowingly giving me full permission to use his figures (Figs. 3.1 and 3.3).

Inspired geoarchaeologies

Geoarchaeological research captures dimensions of the past at an unprecedented level of detail and multiple spatial and temporal scales. The record of the past held by soils and sediments is an archive for past environments, climate change, resource use, settlement lifeways, and societal development and resilience over time. When the McDonald Institute was established at Cambridge, geoarchaeology was one of the priority fields for a new research and teaching environment. An opportunity to develop the legacy of Charles McBurney was bestowed upon Charles French, whose 'geoarchaeology in action' approach has had an enormous impact in advancing knowledge, principles and practices across academic, teaching and professional sectors. Many journeys that began at Cambridge have since proliferated into dozens of inspired geoarchaeologies worldwide. This volume presents research and reflection from across the globe by colleagues in tribute to Charly, under whose leadership the Charles McBurney Laboratory became a beacon of geoarchaeology.

Editors:
Federica Sulas is a senior research associate at the McDonald Institute for Archaeological Research, University of Cambridge. Her background is in oriental studies and African archaeology (BA Hons, Naples) and geoarchaeology (MPhil & PhD, University of Cambridge). Her main research interests are in landscape historical ecologies and water–food security.
Helen Lewis is an associate professor at University College Dublin School of Archaeology. Her background is in archaeology and anthropology (BA, University of Toronto), environmental archaeology (MSc, University of Sheffield) and archaeological soil micromorphology (PhD, University of Cambridge). She mostly works today on cave sites in Southeast Asia, but she still loves northwest European Neolithic and Bronze Age monuments and landscapes, and ancient agricultural soils.
Manuel Arroyo-Kalin is Associate Professor of Geoarchaeology at the Institute of Archaeology, UCL. He is interested in the Anthropocene, human niche construction and historical ecology, and uses earth science methods, including soil micromorphological analysis, to study past anthropic landscape modification and anthropogenic soil formation. His main research focus is the pre-Colonial human landscape history of tropical lowland South America, particularly the Amazon basin, where he is engaged in the long-term comparative study of Amazonian dark earths.

Published by the McDonald Institute for Archaeological Research,
University of Cambridge, Downing Street, Cambridge, CB2 3ER, UK.

The McDonald Institute for Archaeological Research exists to further research by Cambridge archaeologists and their collaborators into all aspects of the human past, across time and space. It supports archaeological fieldwork, archaeological science, material culture studies, and archaeological theory in an interdisciplinary framework. The Institute is committed to supporting new perspectives and ground-breaking research in archaeology and publishes peer-reviewed books of the highest quality across a range of subjects in the form of fieldwork monographs and thematic edited volumes.

Cover design by Dora Kemp and Ben Plumridge.

ISBN: 978-1-913344-09-2

ISBN 978-1-913344-09-2

9 781913 344092

UNIVERSITY OF CAMBRIDGE