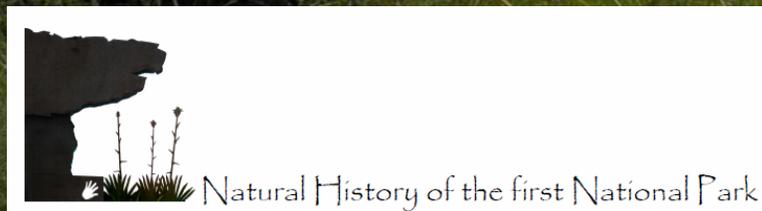
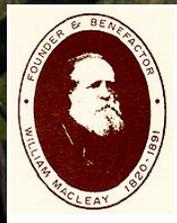




A long term perspective on fire in the Sydney Basin, set against trends in Australia

Dr Scott Mooney

School of BEES
UNSW



Some background I

RESEARCH
REPORT

In 2001 I published...

Clues to the 'burning question': Pre-European fire in the Sydney coastal region from sedimentary charcoal and palynology

By Scott D. Mooney, Kate L. Radford and Gary Hancock

ECOLOGICAL MANAGEMENT & RESTORATION VOL 2 NO 3 DECEMBER 2001

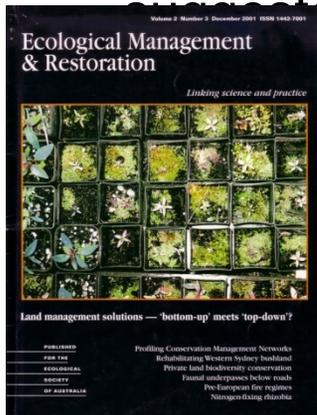
which:

- described palaeoenvironmental analysis of sediments in Jibbon Lagoon RNP;

suggested that fire in the pre-European Jibbon Lagoon was relatively rare (unlike a typical 'Aboriginal fire

post-European period was unusual in terms of fire.

Mooney, S. D., Radford, K. L. & Hancock, G. (2001) Clues to the 'burning question': pre-European fire in the Sydney coastal region from sedimentary charcoal and palynology. *Ecological Management and Restoration* 2(3): 203-12.



Some background II

Since then I have published various case studies of Holocene fire activity in (or near) Sydney region...

- Black, M. and **Mooney**, S. D. (2006) Holocene fire history from the Greater Blue Mountains World Heritage Area, New South Wales, Australia: the climate, humans and fire nexus. *Regional Environmental Change* 6(1-2): 41-51.
- Mooney**, S. D. & Maltby, E. L. (2006) A synthesis of two proxy records revealing the late Holocene fire history at a site on the central coast of New South Wales, Australia. *Austral Ecology*, 31:682-695.
- Black, M. P., **Mooney**, S. D. and Martin, H. A. (2006) A >43 000-year vegetation and fire history from Lake Baraba, New South Wales, Australia. *Quaternary Science Reviews*, 25: 3003-3016.
- Black M. P. and **Mooney**, S. D. (2007) The response of Aboriginal burning practices to population levels and El Nino-Southern Oscillation events during the mid- to late-Holocene: a case study from the Sydney Basin using charcoal and pollen analysis. *Australian Geographer*, 38(1): 37-52.
- Black M. P., **Mooney**, S. D., Haberle, S. G. (2007) The fire, human and climate nexus in the Sydney Basin, eastern Australia. *The Holocene*, 17(4): 465-478.
- Mooney**, S. D., Webb, M. and Attenbrow, V. (2007) A comparison of charcoal and archaeological information to address the influences on Holocene fire activity in the Sydney Basin. *Australian Geographer*, 38: 177-194.
- Black M. P. **Mooney**, S. D. and Attenbrow, V. (2008) Implications of a 14,200 year contiguous fire record for understanding human-climate relationships at Goochs Swamp, New South Wales, Australia. *The Holocene* 18(3): 437-447.

Some background III

In the last *few* years I have been working on *syntheses* (regional, *meso* and global)...

- Power, MJ *et al.* including **Mooney** (2008) Changes in fire activity since the Last Glacial Maximum: an assessment based on a global synthesis of charcoal data. *Climate Dynamics* 30: 887-907.
- **Mooney** *et al.* (2011) Late Quaternary fire regimes in Australia. *Quaternary Science Reviews* 30: 28-46.
- **Mooney** *et al.* (*in press*) The Prehistory of Fire in Australasia. A chapter for the CSIRO Press update of *Flammable Australia*.
- Daniau, A-L W. *et al.* including **Mooney** (*submitted*) Predictability of biomass burning in response to climate changes. Submitted to *Global Change Biology*, Sept. 2011.



BLACK CHRISTMAS FIRES

THE Daily Telegraph

Wednesday, January 2, 2002

90 cents*
Including GST M

**On a scorching afternoon, arsonists
make a city's nightmare come true**



A helitanker drops 9500 litres of water on fires as they rage through Lane Cove National Park towards homes at North Epping yesterday. Picture: MARC MCCORMACK

SYDNEY BURNS

■ **Suburbs fight running battle with flames**

— Pages 2, 3, 4

■ **Hundreds flee mountain firestorm**

— Page 5

■ **Exclusive: Hunt for the fire suspect**

— Page 7



Fires in Busaco Rd, Marsfield yesterday. Picture: ROSS SCHULTZ



NEWSPAPER OF THE YEAR

THE AUSTRALIAN

NUMBER 11,593

WEDNESDAY JANUARY 2 2002

www.theaustralian.com.au

\$1.10* Includes GST *High Rate \$1.30 Inc

DESPERATE START TO NEW YEAR

Fires burst into suburbs



BLACK CHRISTMAS FIRES



The Sun-Herald

DAY, FEBRUARY 8, 2009

\$2 INCLUDING GST

VICTORIA WEEPS: STATE OF INFERNO

DAY OF DEATH

confirmed dead ● Toll could pass 4

The problems...

After every conflagration in Australia...

- **claims** about recent fire are stated as facts
 - *unprecedented* fire size
 - *unprecedented* fire behavior
- ‘popular’ commentators claim that intensive fuel reduction should be undertaken to mimic Aboriginal-style fire management.

This has a number of consequences...

- it tends to imply that we *know* what happened in the past;
- it presents a simplistic and static view of the past;
- assumptions may present false goals for management.



I am not making this up...



Green ideas must take blame for deaths

Miranda Devine

February 12, 2009

Page 1 of 3 | [Single Page View](#)

It wasn't climate change which killed as many as 300 people in Victoria last weekend. It wasn't arsonists. It was the unstoppable intensity of a bushfire, turbo-charged by huge quantities of ground fuel which had been allowed to accumulate over years of drought. It was the power of green ideology over government to oppose attempts to reduce fuel



Source: <http://www.smh.com.au/environment/green-ideas-must-take-blame-for-deaths-20090211-84mk.html>

Challenging (fire) myths?

CSIRO PUBLISHING

www.publish.csiro.au/journals/ijwf

International Journal of Wildland Fire 2008, 17, 809–822

Effects of large fires on biodiversity in south-eastern Australia: disaster or template for diversity?

Ross A. Bradstock

Table 1. A summary of perceptions concerning the effects of large fires on biodiversity

Supporting examples are drawn from statements made during hearings by the House of Representatives Select Committee into Australian bushfires, during 2003 (see Appendix 1)

Perceptions	Examples
Large fires are 'abnormal' or unnatural	'I do not know whether you fellows can remember, but years ago there did not seem to be big fires like the ones we have today. I really think we have to get back in a small way to what they used to do years ago. . .'
Large fires are intense	'I call them 'feral' because of their impact – the intense feral fires that burn asphalt.'
Large fires are homogeneous	'But surely in a high-intensity fire everything gets burned and absolutely destroyed.'
Large fires kill everything	'...warned for over a decade that a lightning strike in there would destroy an enormous amount of biodiversity, which has now happened. It has destroyed the biodiversity to the point, as I said earlier, where it has vaporised any known seed stock that may have been below the ground, because it sterilised the earth to 40 feet [12.19 m] below the surface in some areas.'
Recovery of organisms is dependent on immigration or dispersal	
Large fires 'degrade'	'...extremely hot fires that have occurred in an environment where they have totally wiped out species and where the only way we can see any vegetation returning is by aerial seeding of some of those areas. . .'
Large fires transform ecosystems	

Challenging (fire) myths?

International Journal of Wildland Fire 2008, 17, 793–808

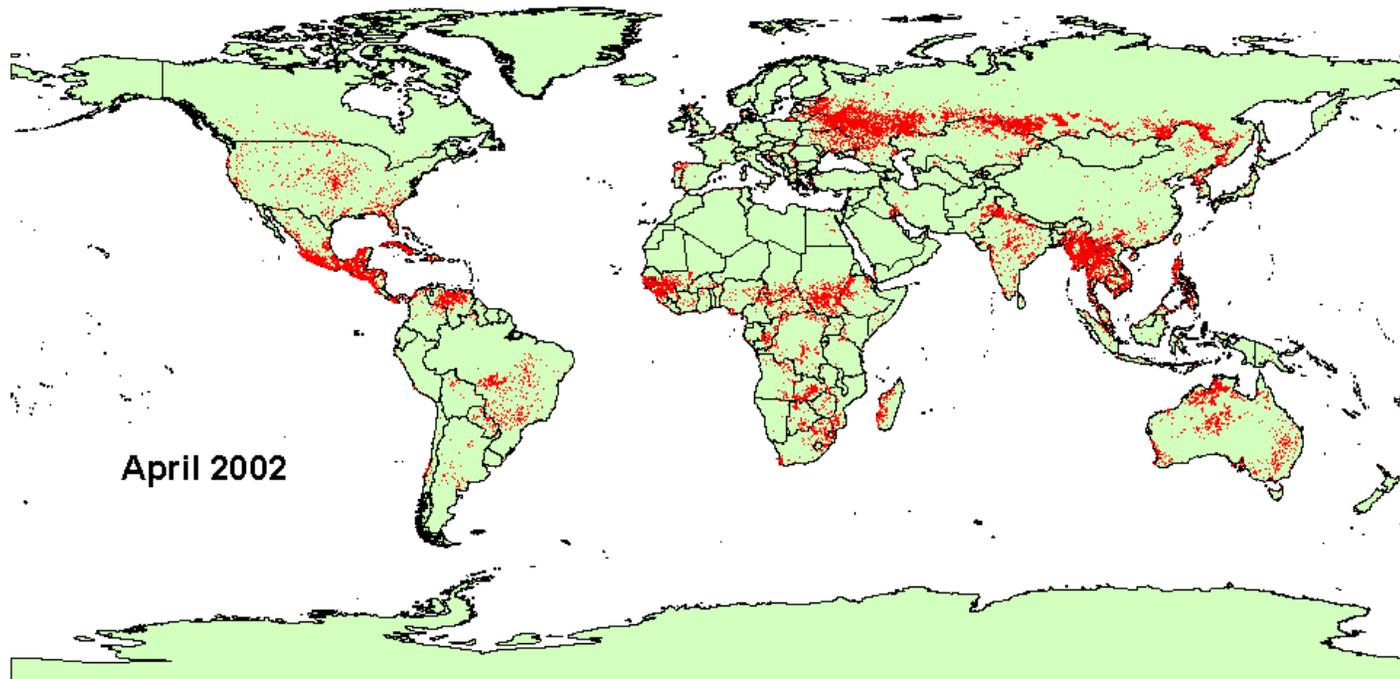
Large fires in Australian alpine landscapes: their part in the historical fire regime and their impacts on alpine biodiversity

Richard J. Williams^{A,H}, Carl-Henrik Wahren^B, Arn D. Tolsma^C,
Glenn M. Sanecki^{D,*}, Warwick A. Papst^B, Bronwyn A. Myers^E,
Keith L. McDougall^F, Dean A. Heinze^G and Ken Green^D

Abstract. The fires of summer 2003 in south-eastern Australia burnt tens of thousands of hectares of treeless alpine landscape. Here, we examine the environmental impact of these fires, using data from the Bogong High Plains area of Victoria, and the Snowy Mountains region of New South Wales. Historical and biophysical evidence suggests that in Australian alpine environments, extensive fires occur only in periods of extended regional drought, and when severe local fire weather coincides with multiple ignitions in the surrounding montane forests. Dendrochronological evidence indicates that large fires have occurred approximately every 50–100 years over the past 400 years. Post-fire monitoring of vegetation in grasslands and heathlands indicates that most alpine species regenerate rapidly after fire, with >90% of species present 1 year after fire. Some keystone species in some plant communities, however, had not regenerated after 3 years. The responses of alpine fauna to the 2003 fires were variable. The core habitat (closed heathland) of several vulnerable small mammals was extensively burnt. Some mammals experienced substantial falls in populations, others experienced substantial increases. Unburnt patches of vegetation are critical to faunal recovery from fire. There was, however, no evidence of local extinction. We conclude that infrequent extensive fires are a feature of alpine Australia. For both the flora and fauna, there is no quantitative evidence that the 2003 fires were an ecological disaster, and we conclude that the flora and fauna of alpine Australia are highly resilient to infrequent, large, intense fires.

the modern instrumental record...

MODIS Land Rapid Response Fire Detections



Legend

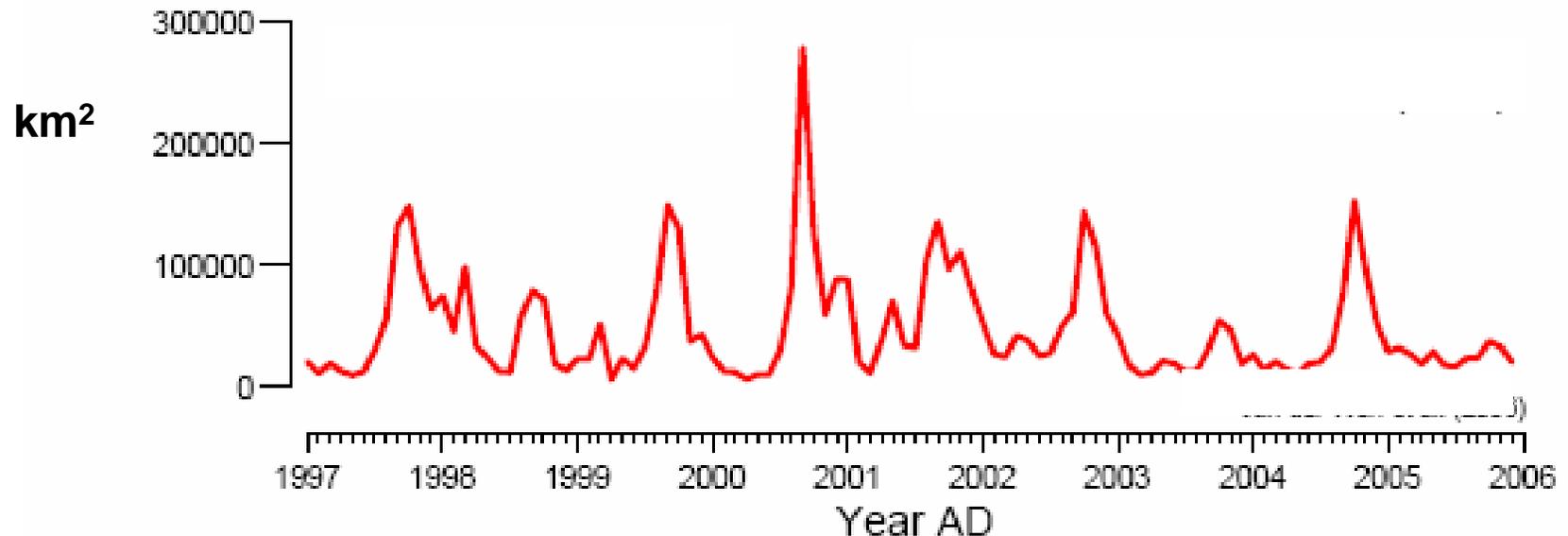
• MODIS Fire Detections from the Terra Satellite

World Countries

Estimates of area burnt in Australasia...

Annual average total burnt fraction from the GFED v2.1 data set
van der Werf, Randerson, Giglio, Collatz, Kasibhatla and Arellano (2006) Interannual variability of global biomass burning emissions from 1997 to 2004. *Atmospheric Chemistry and Physics Discussions* 6, 3175-3226.

See Guido van der Werf's description of this work at
<http://www.falw.vu/~gwerf/GFED/>



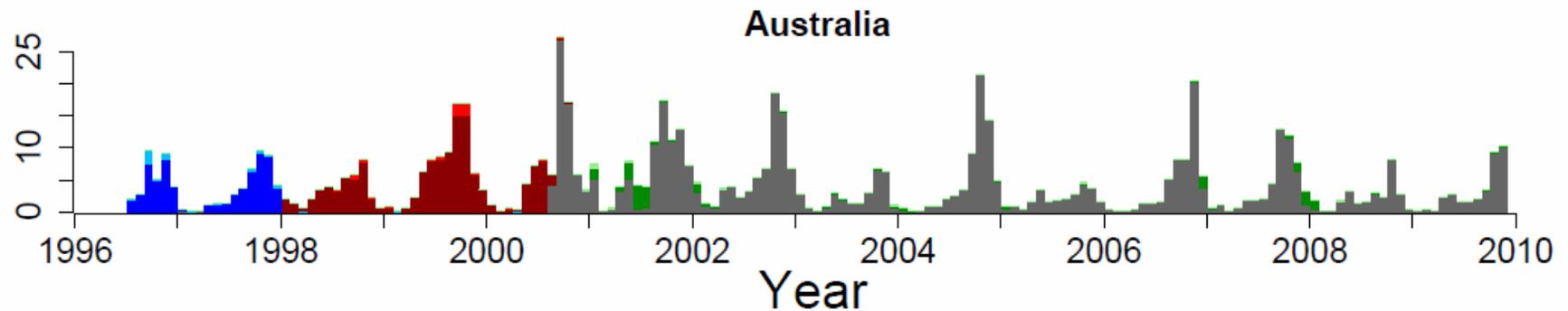
Assessing variability and long-term trends in burned area by merging multiple satellite fire products

2010

L. Giglio^{1,2}, J. T. Randerson³, G. R. van der Werf⁴, P. S. Kasibhatla⁵, G. J. Collatz¹, D. C. Morton¹, and R. S. DeFries⁶

Biogeosciences 7(3):1171-1186.

Abstract. Long term, high quality estimates of burned area are needed for improving both prognostic and diagnostic fire emissions models and for assessing feedbacks between fire and the climate system. We developed global, monthly burned area estimates aggregated to 0.5° spatial resolution for the time period July 1996 through mid-2009 using four satellite data sets. From 2001–2009, our primary data source was 500-m burned area maps produced using Moderate Resolution Imaging Spectroradiometer (MODIS) surface reflectance imagery; more than 90% of the global area burned during this time period was mapped in this fashion. Dur-



Monthly Burned Area (Mha)

The global carbon cycle

- Currently, CO₂ emissions from fire are ~50% (2 to 4 Pg C/y) of those from fossil-fuel combustion (7.2 Pg C/y). Year-to-year variation is huge.
- Burning related to deforestation, a net CO₂ source, contributes about 0.65 Pg C year⁻¹.
- In contrast, the regrowth of vegetation is a sink of atmospheric CO₂. Burning also produces black carbon aerosols (which strongly absorb solar radiation, and may have the strongest effect on global climate change from CO₂).

www.sciencemag.org SCIENCE VOL 324 24 APRIL 2009

Fire in the Earth System

David M. J. S. Bowman,^{1*} Jennifer K. Balch,^{2,3,4**†} Paulo Artaxo,⁵ William J. Bond,⁶ Jean M. Carlson,⁷ Mark A. Cochrane,⁸ Carla M. D'Antonio,⁹ Ruth S. DeFries,¹⁰ John C. Doyle,¹¹ Sandy P. Harrison,¹² Fay H. Johnston,¹³ Jon E. Keeley,^{14,15} Meg A. Krawchuk,¹⁶ Christian A. Kull,¹⁷ J. Brad Marston,¹⁸ Max A. Moritz,¹⁶ I. Colin Prentice,¹⁹ Christopher I. Roos,²⁰ Andrew C. Scott,²¹ Thomas W. Swetnam,²² Guido R. van der Werf,²³ Stephen J. Pyne²⁴

Fire is a worldwide phenomenon that appears in the geological record soon after the appearance of terrestrial plants. Fire influences global ecosystem patterns and processes, including vegetation distribution and structure, the carbon cycle, and climate. Although humans and fire have always coexisted, our capacity to manage fire remains imperfect and may become more difficult in the future as climate change alters fire regimes. This risk is difficult to assess, however, because fires are still poorly represented in global models. Here, we discuss some of the most important issues involved in developing a better understanding of the role of fire in the Earth system.

Bowman, D.M.J.S *et al.* (2009) Fire in the Earth System. *Science* **324**, 481-4.

Palaeoenvironmental information

- from natural ***archives*** that develop sequentially and in doing so *record* some aspect of the environment;
 - e.g. ice-cores, tree rings, sediments;
 - based on environmental archives or proxies that are sensitive to the environmental condition or process under examination;
- **extend instrumental records;**
 - slow processes, rare/extreme events, environmental responses;
 - baselines, detect longer-term trends or dynamics;
 - the magnitude and rates of change;
- some questions are inherently historical;
 - what happened when...?
- provides insights into the environmental responses to a changing environment;
 - what *will* happen when...? (analogues for our potential future;)
- used to test ecological theories or environmental models.

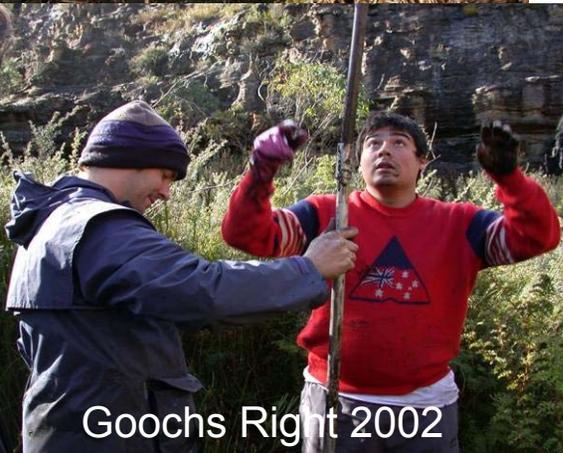
A longer perspective on fire...

Methods...

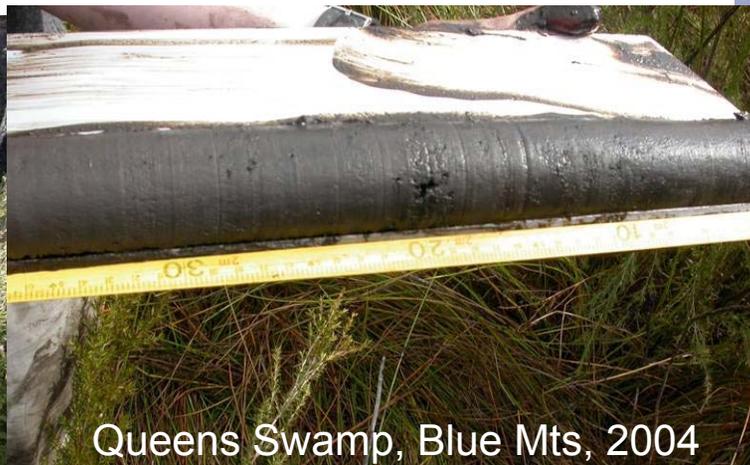
- Obtaining sediment cores;
- Radiometric dating (^{14}C , ^{210}Pb);
- Quantification of macroscopic charcoal (wet sieving & image analysis);
- Palynology;
- Statistical analyses.



Griffith Swamp 2004



Goochs Right 2002



Queens Swamp, Blue Mts, 2004



Goochs
Right
#20 (20-21)



Charcoal Accumulates in Lake and Swamp Sediments

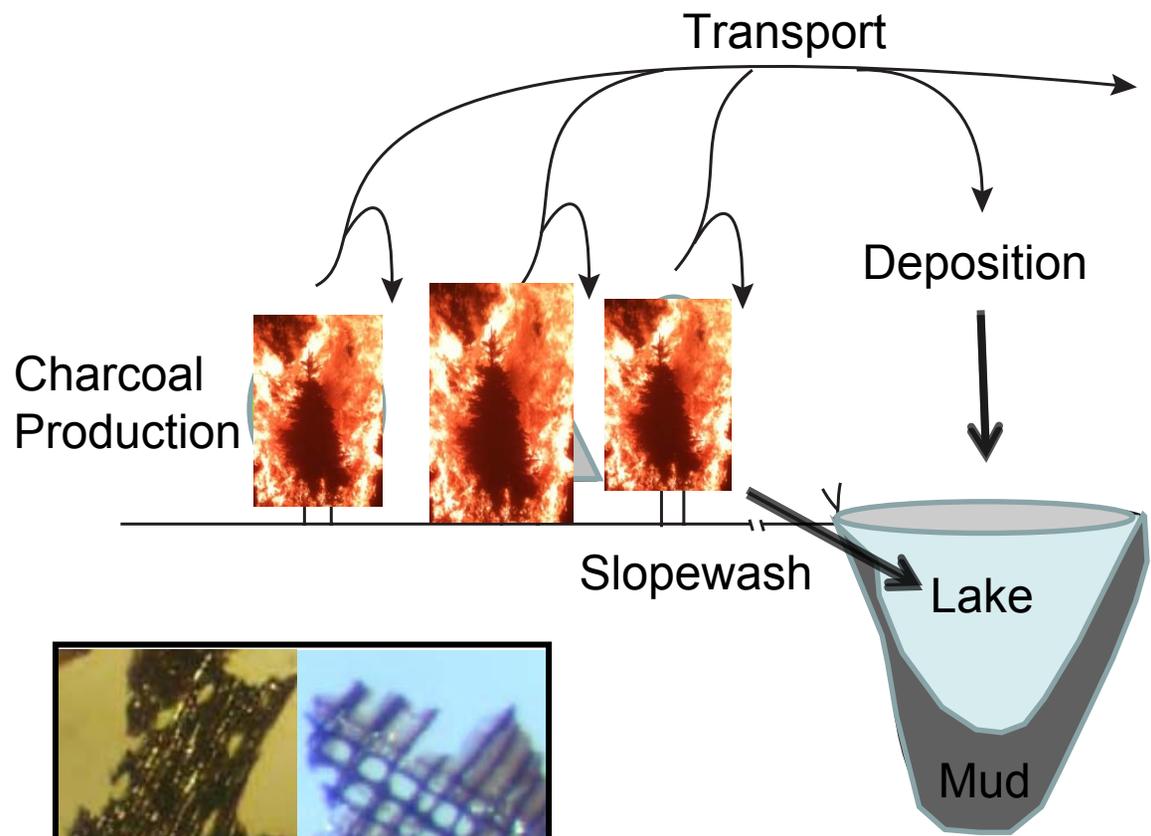
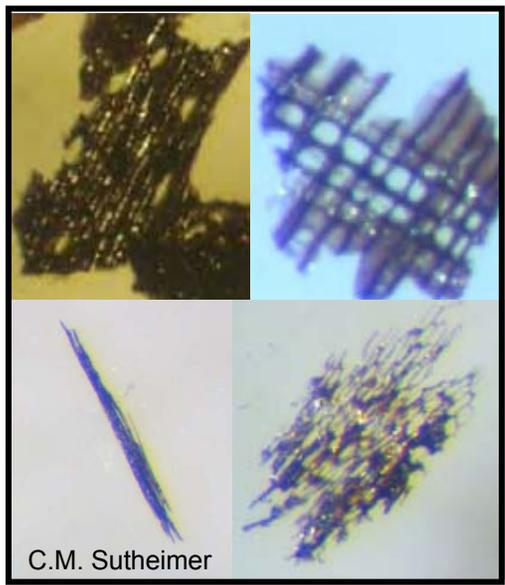
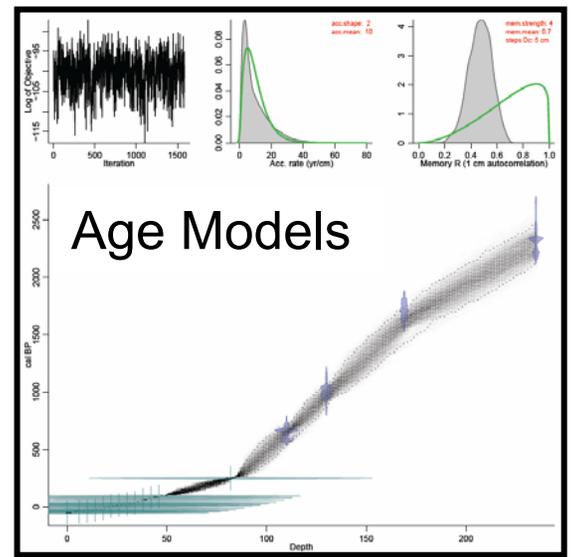


Photo: M. J. Power



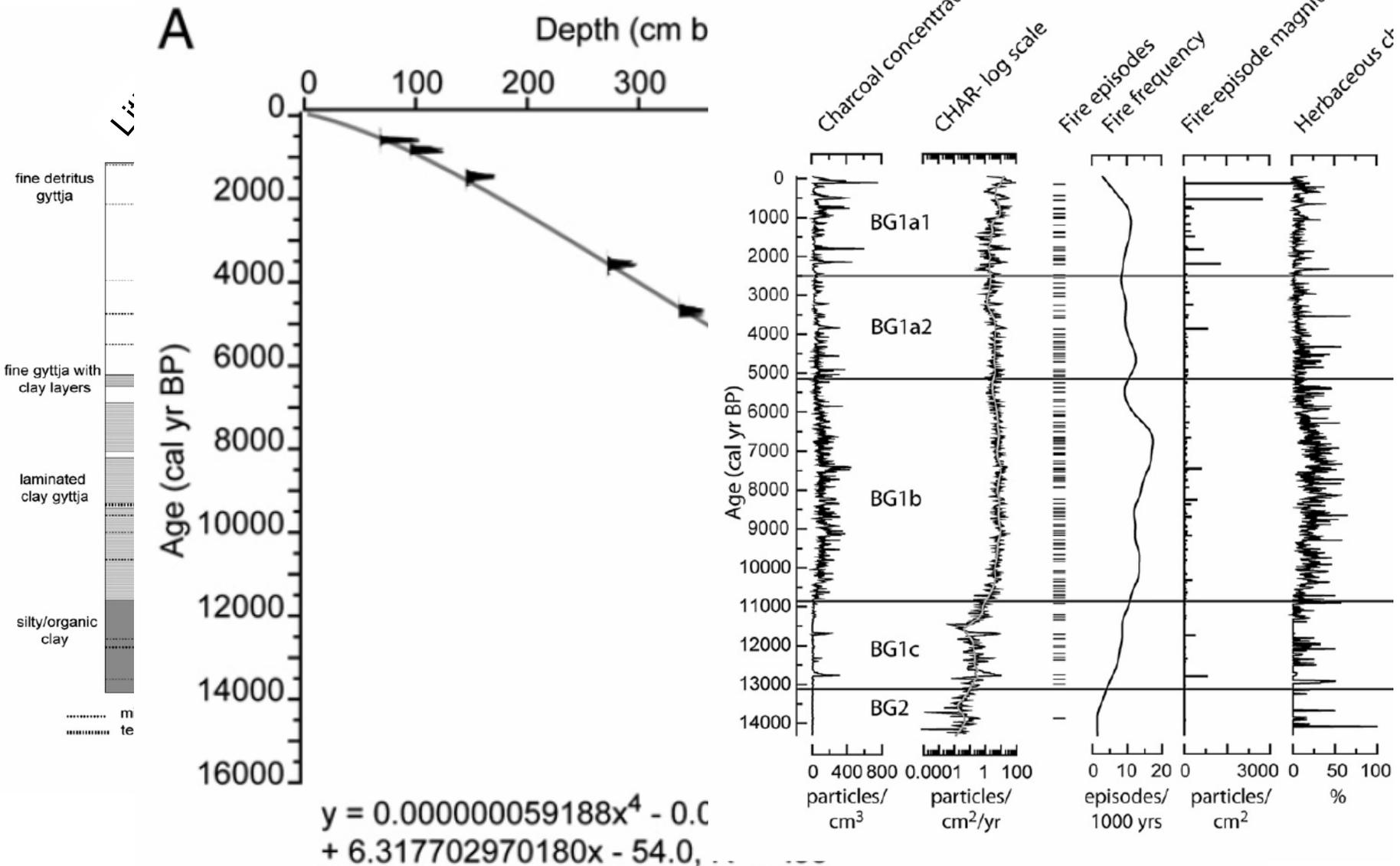
Sample Charcoal Particles

C.M. Sutherland



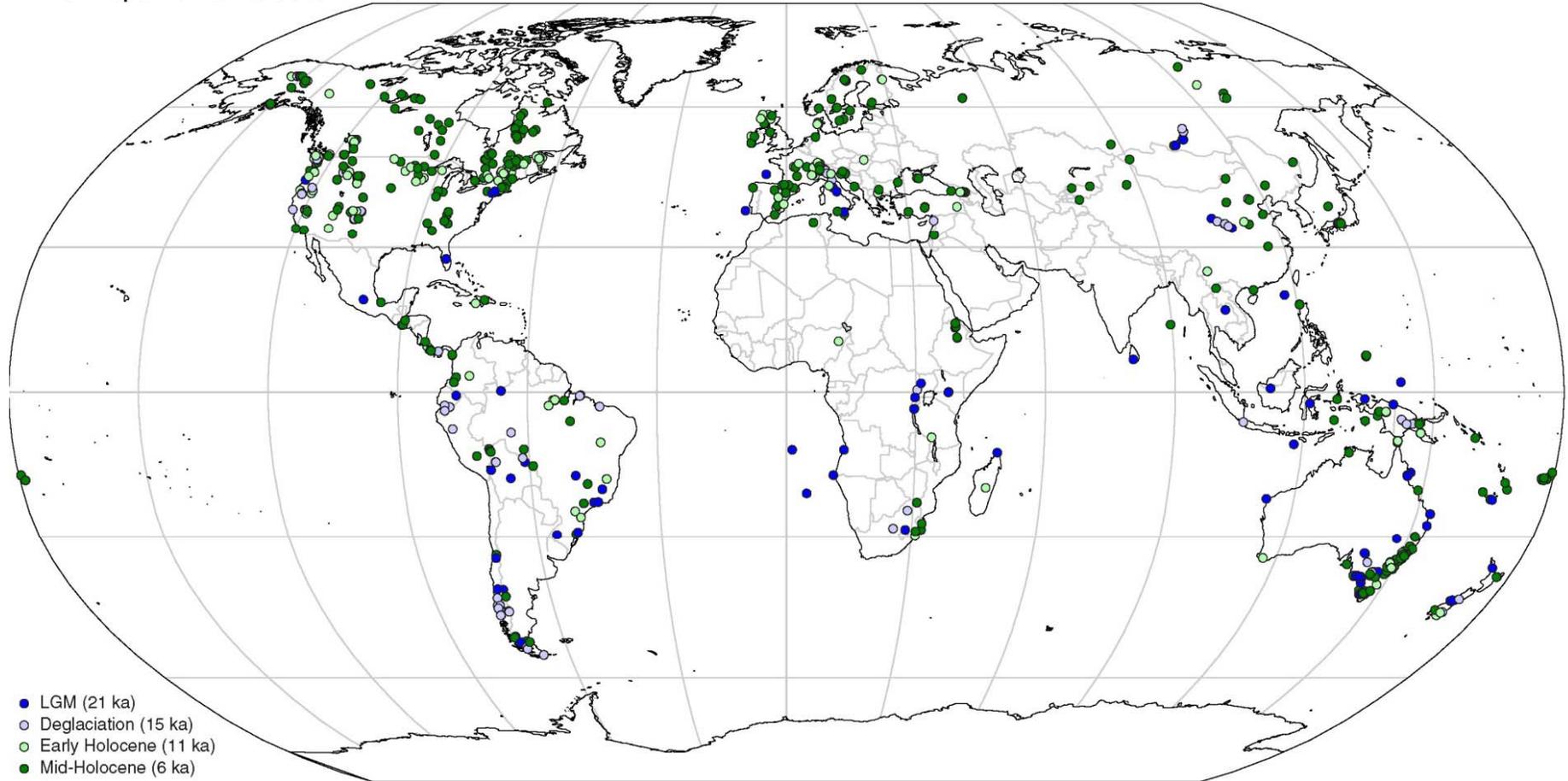
From charcoal influx to frequency

A



The tools: the GPWG database

Time Depth of Charcoal Records



Global Charcoal Dataset (version 2, n = 679)

Daniau *et al.* submitted

Data Processing

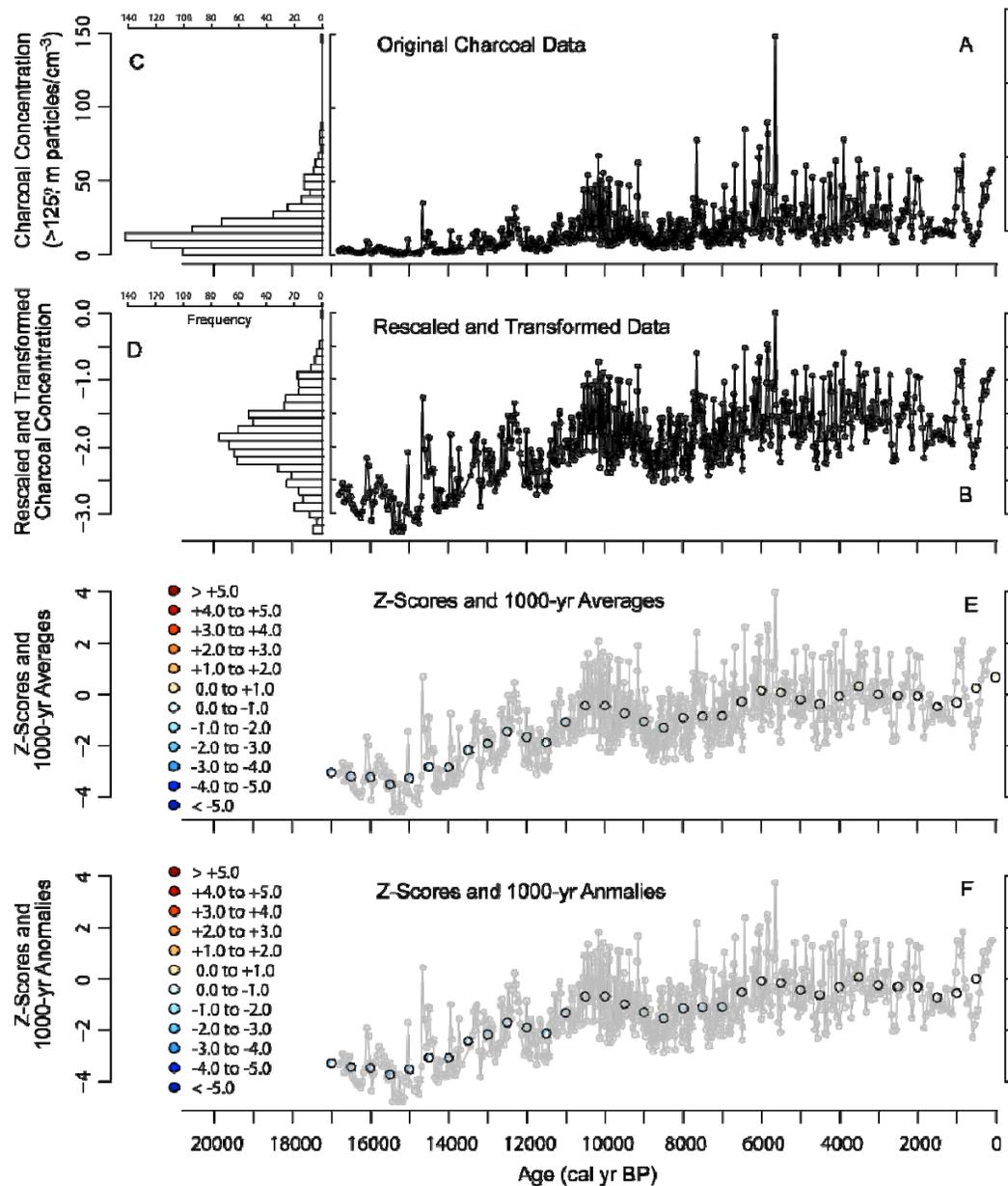
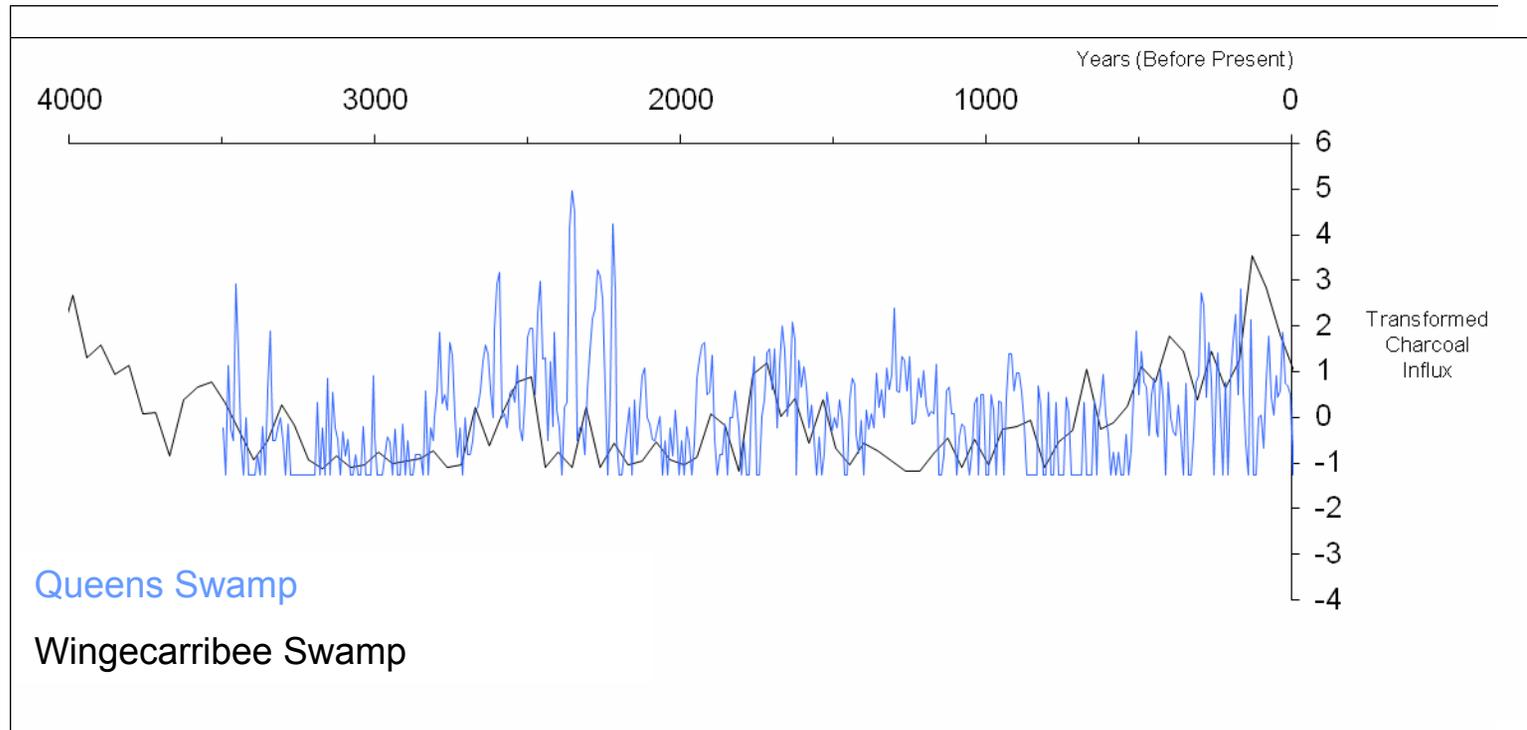
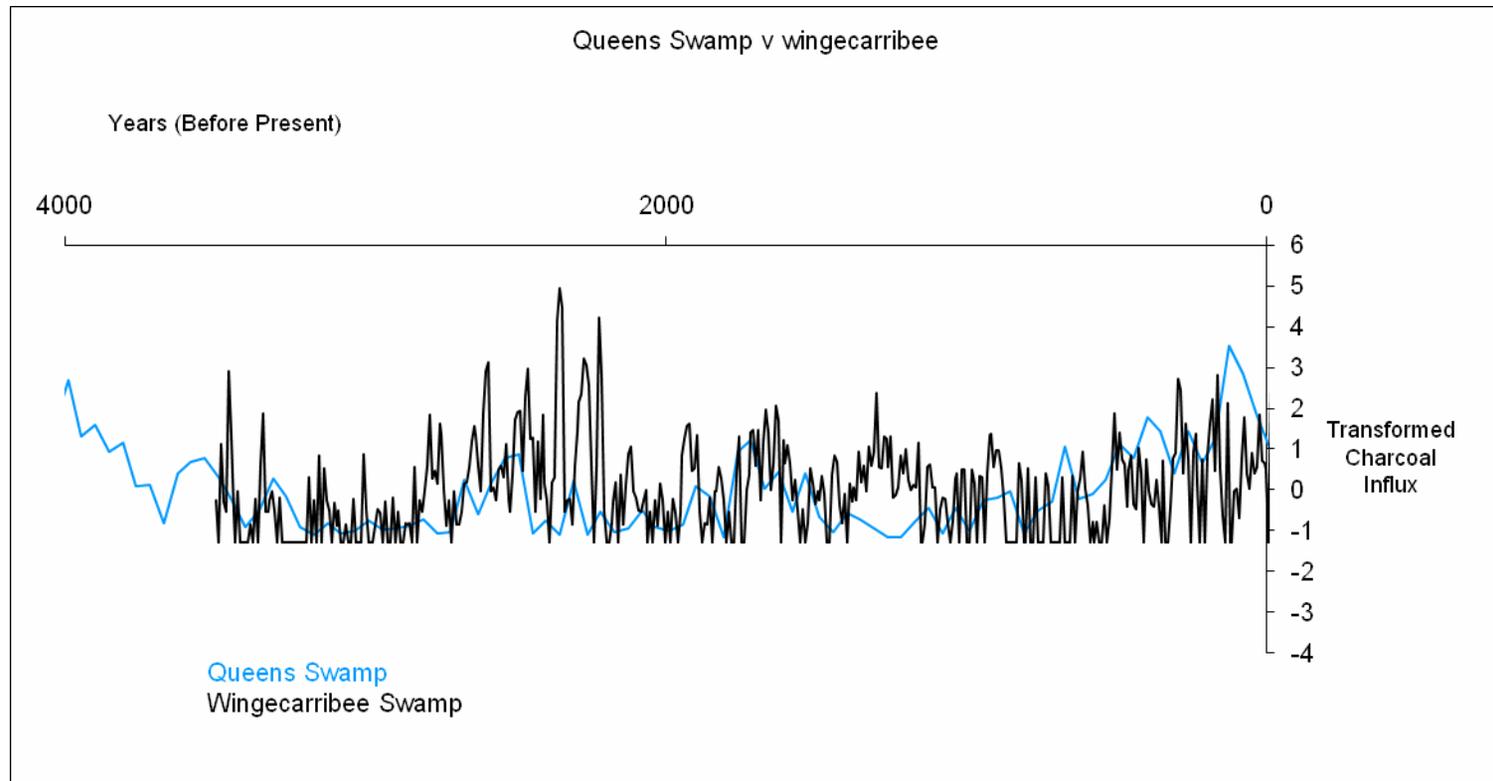


Figure 3

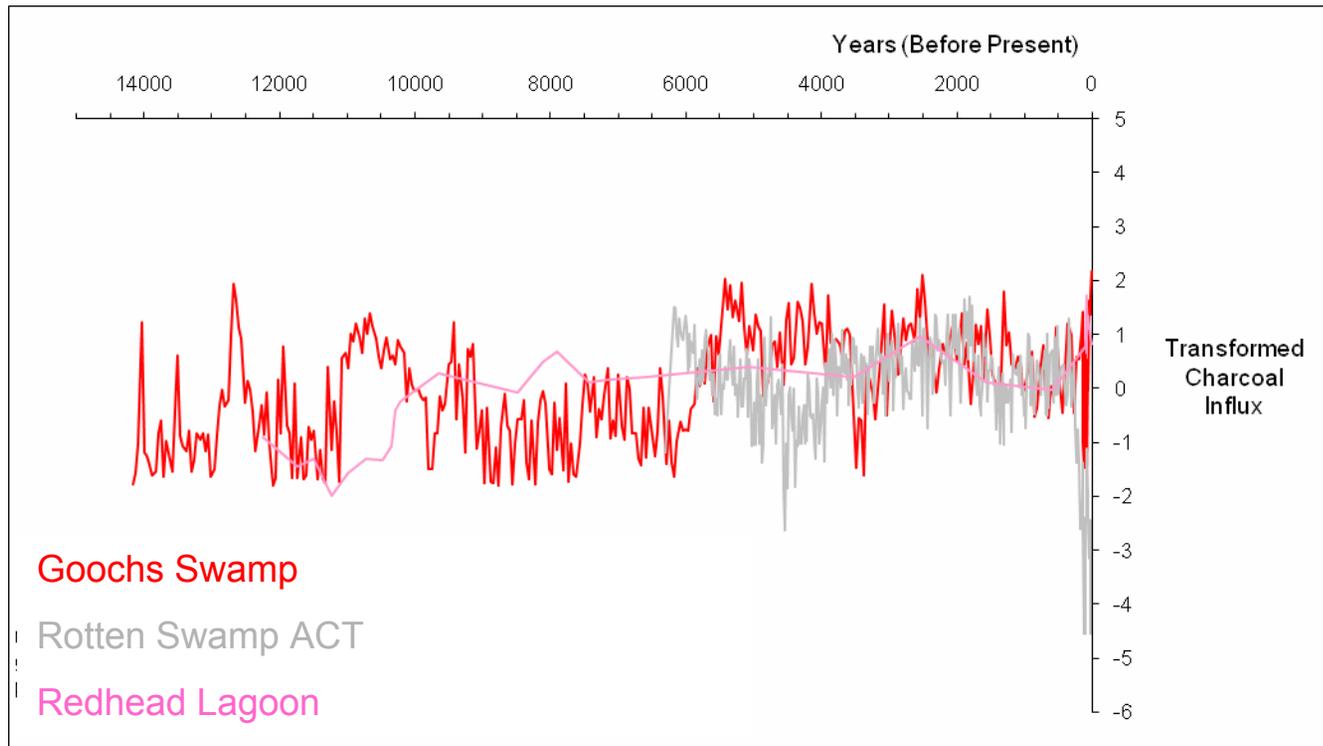
Data processing allows inter-site comparisons...



inter-site comparisons...



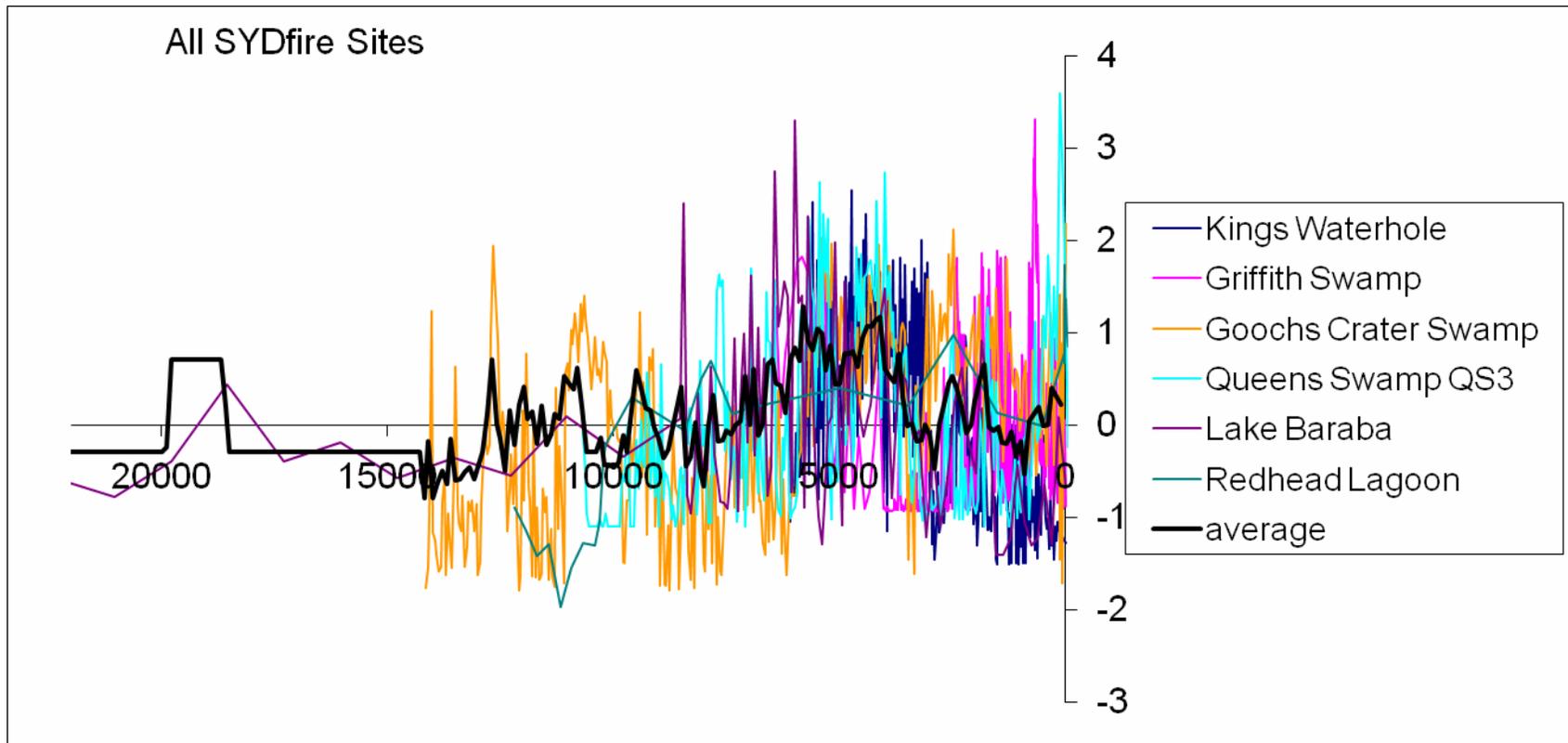
Eastern Australian inter-site comparison

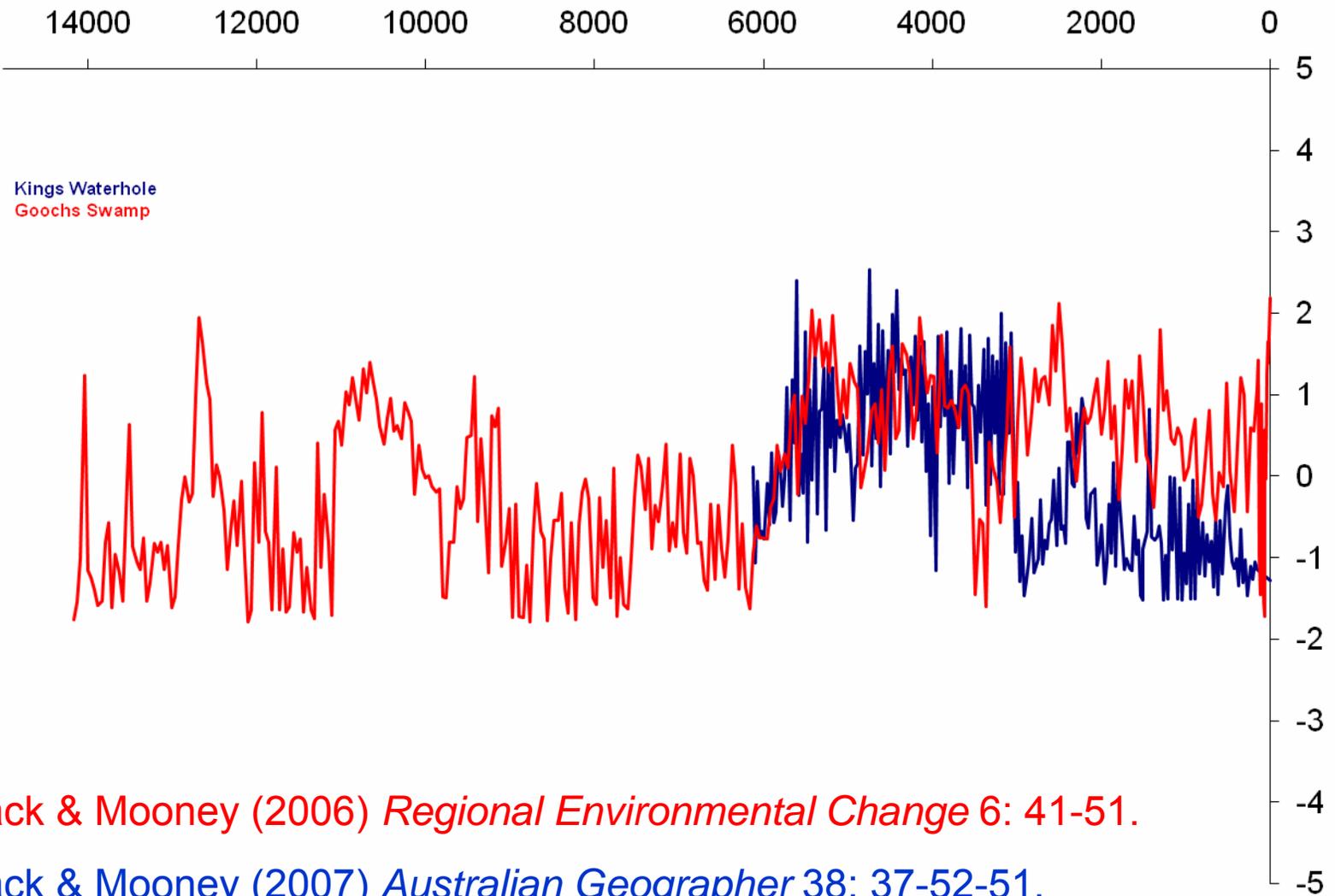


“The hallmark of climatic influence on fire history is fire event synchrony at landscape to regional scales”

(Tom Swetnam, IGBP Fire Regimes FTI, Boulder, Nov., 2004)

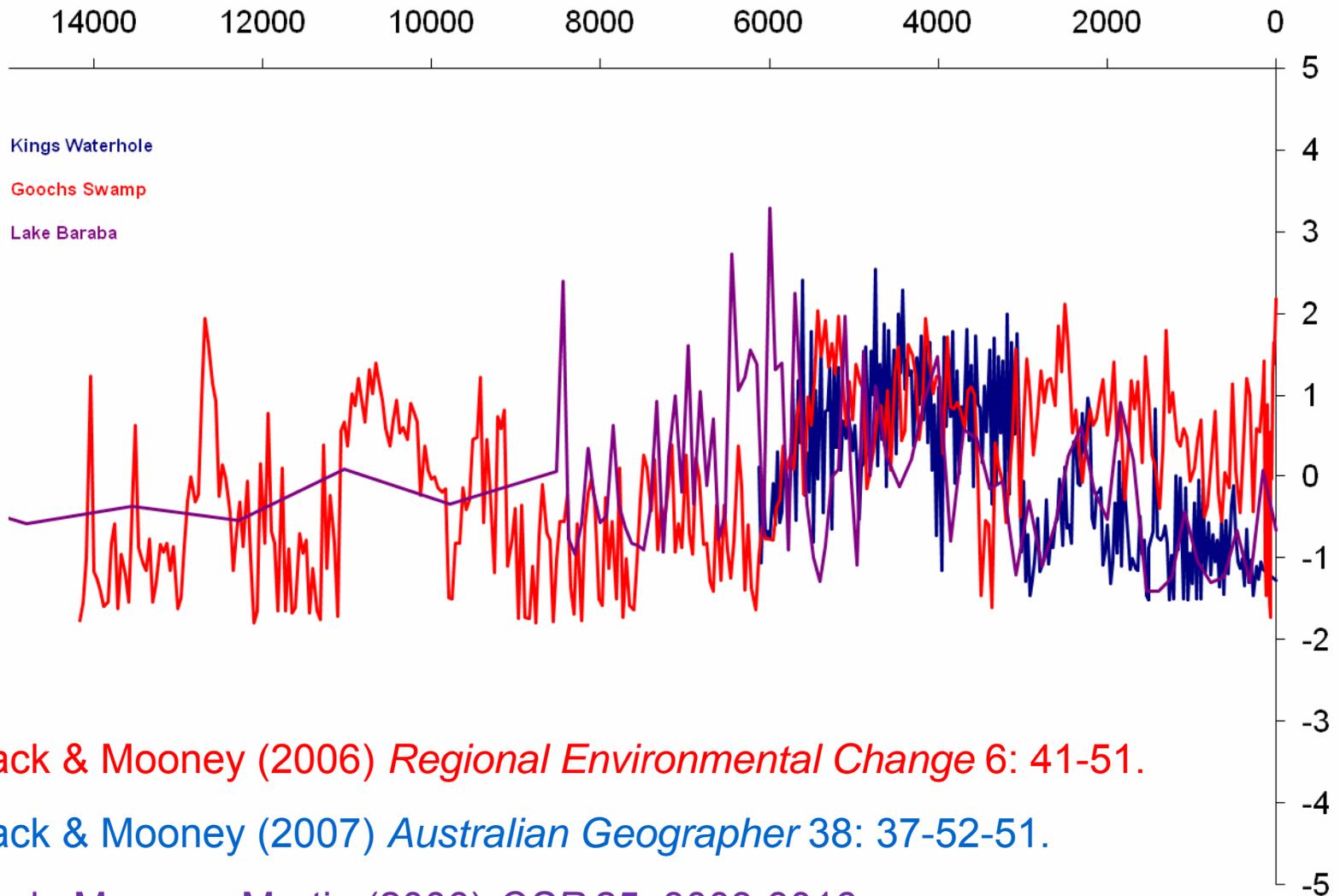
All Sydney inter-site comparisons...





Black & Mooney (2006) *Regional Environmental Change* 6: 41-51.

Black & Mooney (2007) *Australian Geographer* 38: 37-52-51.



Black & Mooney (2006) *Regional Environmental Change* 6: 41-51.

Black & Mooney (2007) *Australian Geographer* 38: 37-52-51.

Black, Mooney, Martin (2006) *QSR* 25: 3003-3016

Late Quaternary fire regimes of Australasia

S.D. Mooney^{a,*}, S.P. Harrison^b, P.J. Bartlein^c, A.-L. Daniau^d, J. Stevenson^e, K.C. Brownlie^f, S. Buckman^f, M. Cupper^g, J. Luly^h, M. Black^a, E. Colhounⁱ, D. D'Costa^j, J. Dodson^k, S. Haberle^e, G.S. Hope^e, P. Kershaw^l, C. Kenyon^m, M. McKenzie^l, N. Williamsⁿ

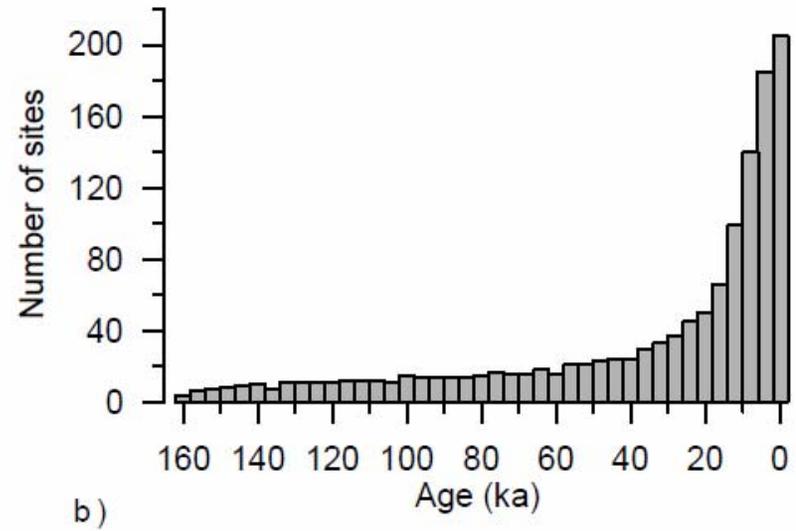
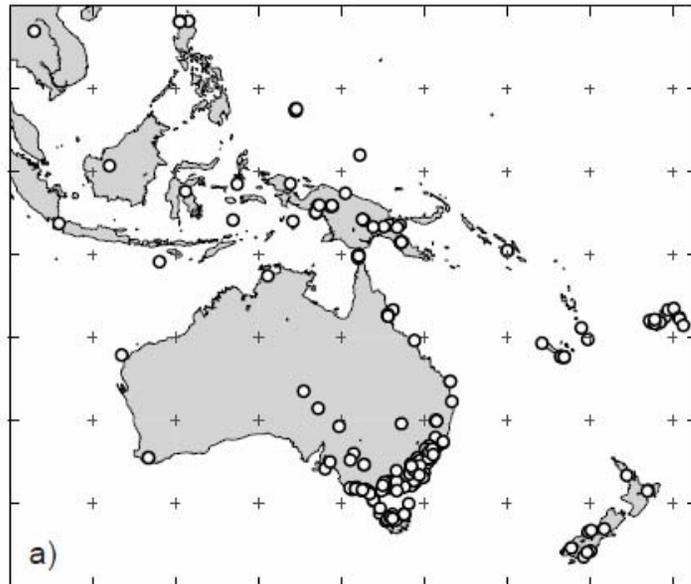
Quaternary Science Reviews 30 (2011) 28–46

A B S T R A C T

We have compiled 223 sedimentary charcoal records from Australasia in order to examine the temporal and spatial variability of fire regimes during the Late Quaternary. While some of these records cover more than a full glacial cycle, here we focus on the last 70,000 years when the number of individual records in the compilation allows more robust conclusions. On orbital time scales, fire in Australasia predominantly reflects climate, with colder periods characterized by less and warmer intervals by more biomass burning. The composite record for the region also shows considerable millennial-scale variability during the last glacial interval (73.5–14.7 ka). Within the limits of the dating uncertainties of individual records, the variability shown by the composite charcoal record is more similar to the form, number and timing of Dansgaard–Oeschger cycles as observed in Greenland ice cores than to the variability expressed in the Antarctic ice-core record. The composite charcoal record suggests increased biomass burning in the Australasian region during Greenland Interstadials and reduced burning during Greenland Stadials. Millennial-scale variability is characteristic of the composite record of the subtropical high pressure belt during the past 21 ka, but the tropics show a somewhat simpler pattern of variability with major peaks in biomass burning around 15 ka and 8 ka. There is no distinct change in fire regime corresponding to the arrival of humans in Australia at 50 ± 10 ka and no correlation between archaeological evidence of increased human activity during the past 40 ka and the history of biomass burning. However, changes in biomass burning in the last 200 years may have been exacerbated or influenced by humans.

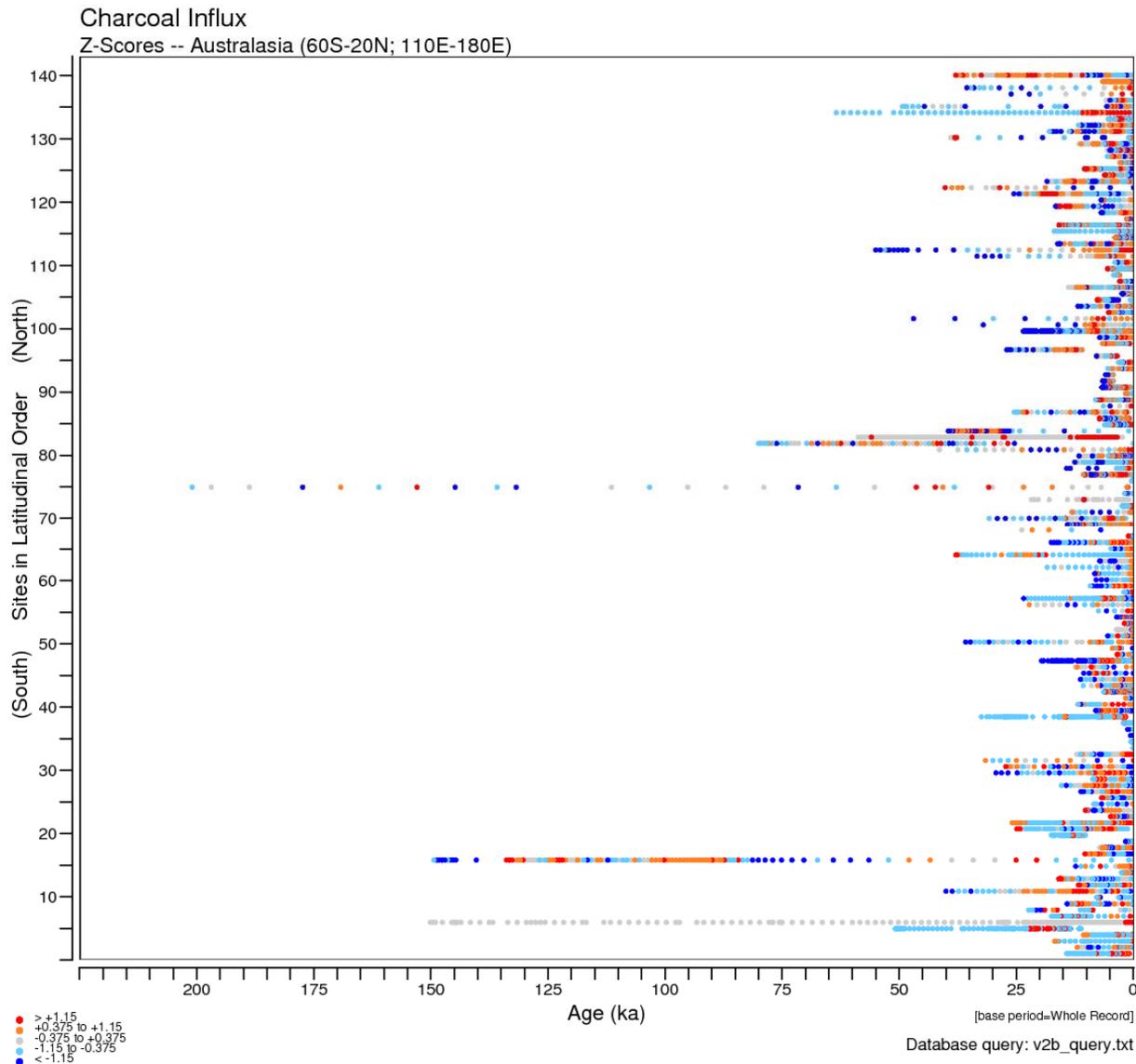
2.

1.



Late Quaternary fire regimes of Australasia

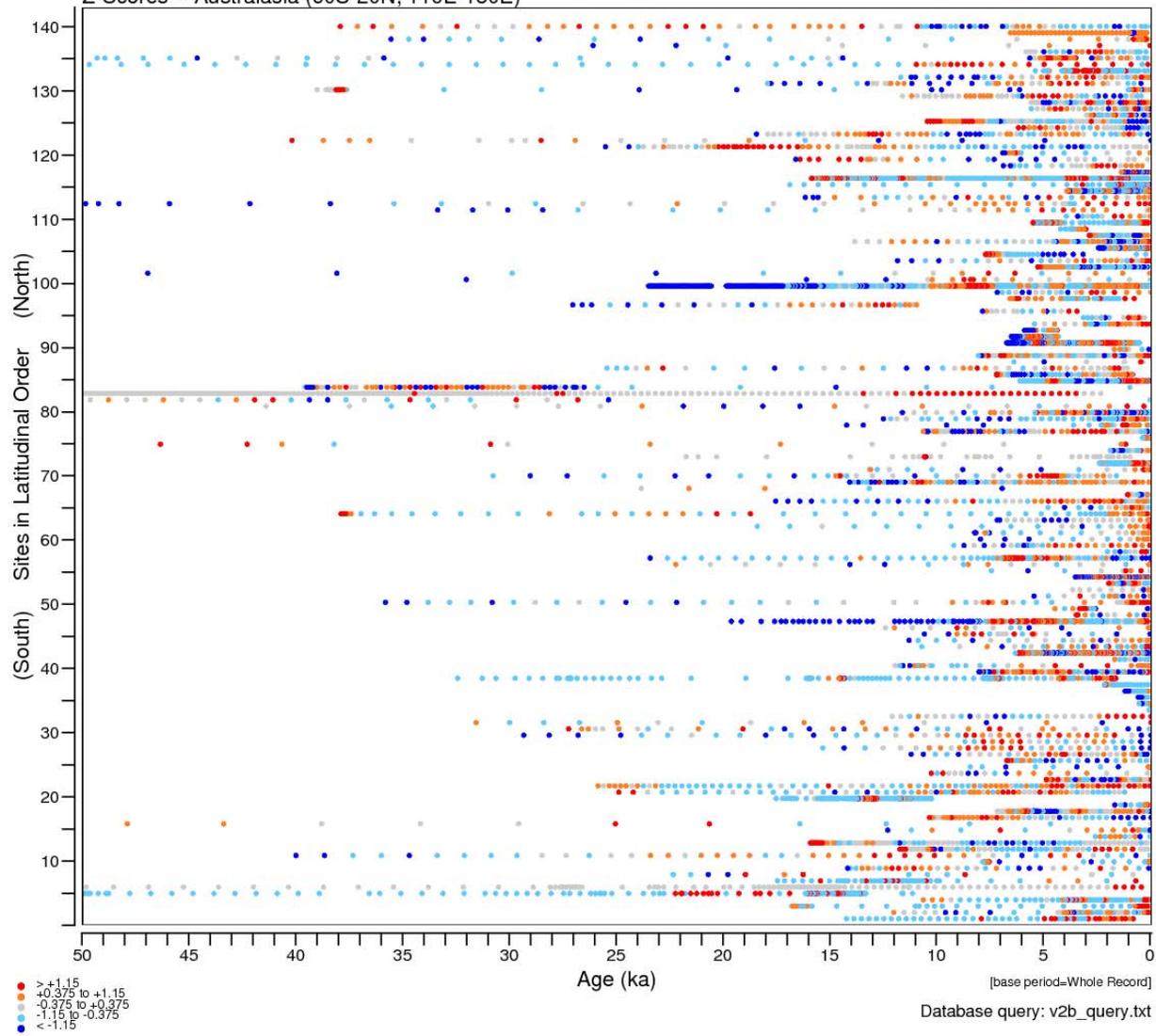
S.D. Mooney^{a,*}, S.P. Harrison^b, P.J. Bartlein^c, A.-L. Daniiau^d, J. Stevenson^e, K.C. Brownlie^f, S. Buckman^f, M. Cupper^g, J. Luly^h, M. Black^a, E. Colhounⁱ, D. D'Costa^j, J. Dodson^k, S. Haberle^e, G.S. Hope^e, P. Kershaw^l, C. Kenyon^m, M. McKenzie^l, N. Williamsⁿ



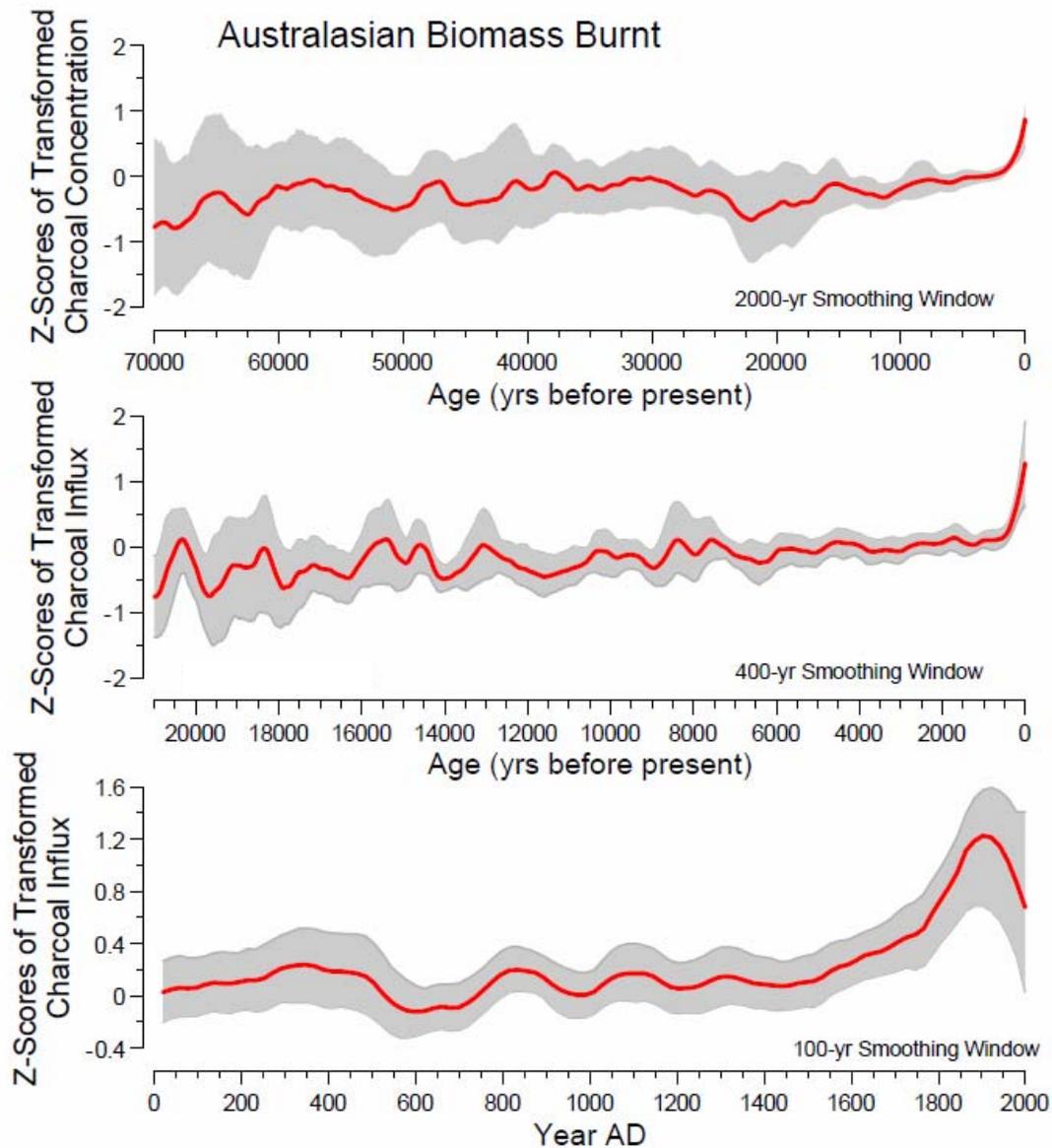
Hovmöller (1949 in *Tellus* 1, 2153–3490) diagrams are two-dimensional plots showing how the value of some attribute varies in space–time; one axis refers to time and the other to spatial location. They are particularly useful for displaying large amounts of data.

Hovmöller diagram by latitudinal order last 200ky

Charcoal Influx
Z-Scores -- Australasia (60S-20N; 110E-180E)



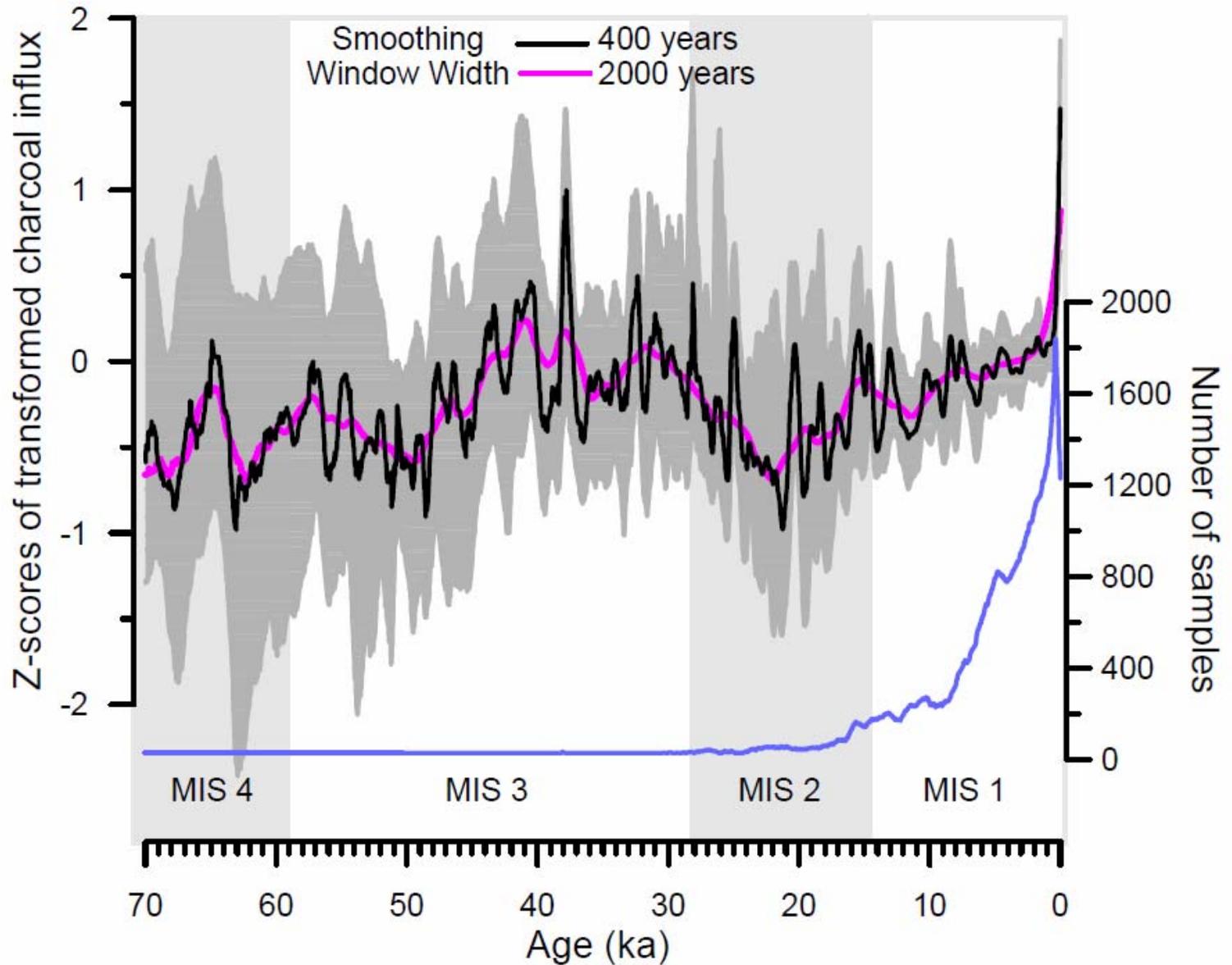
Hovmöller diagram by latitudinal order last 50ky

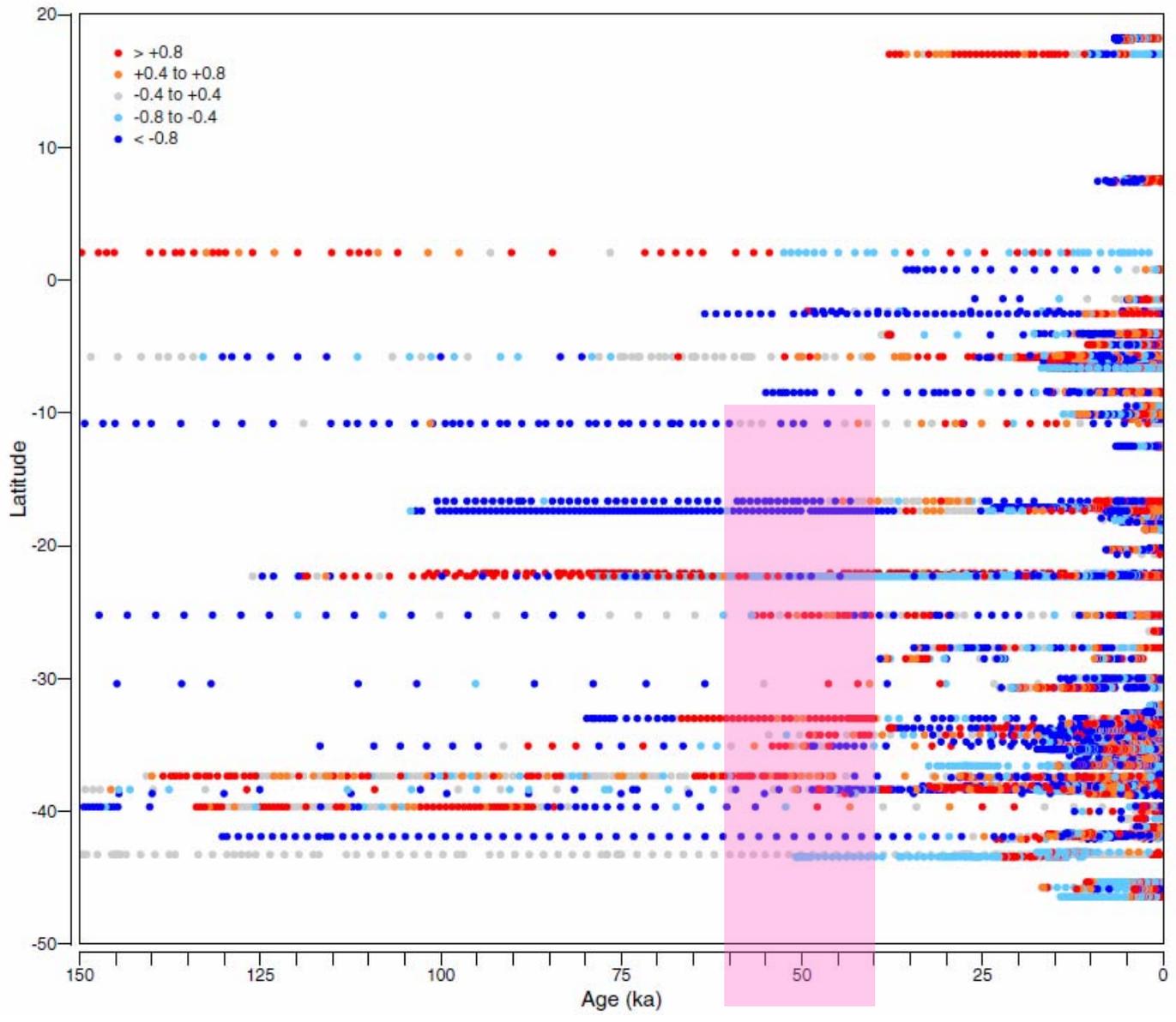


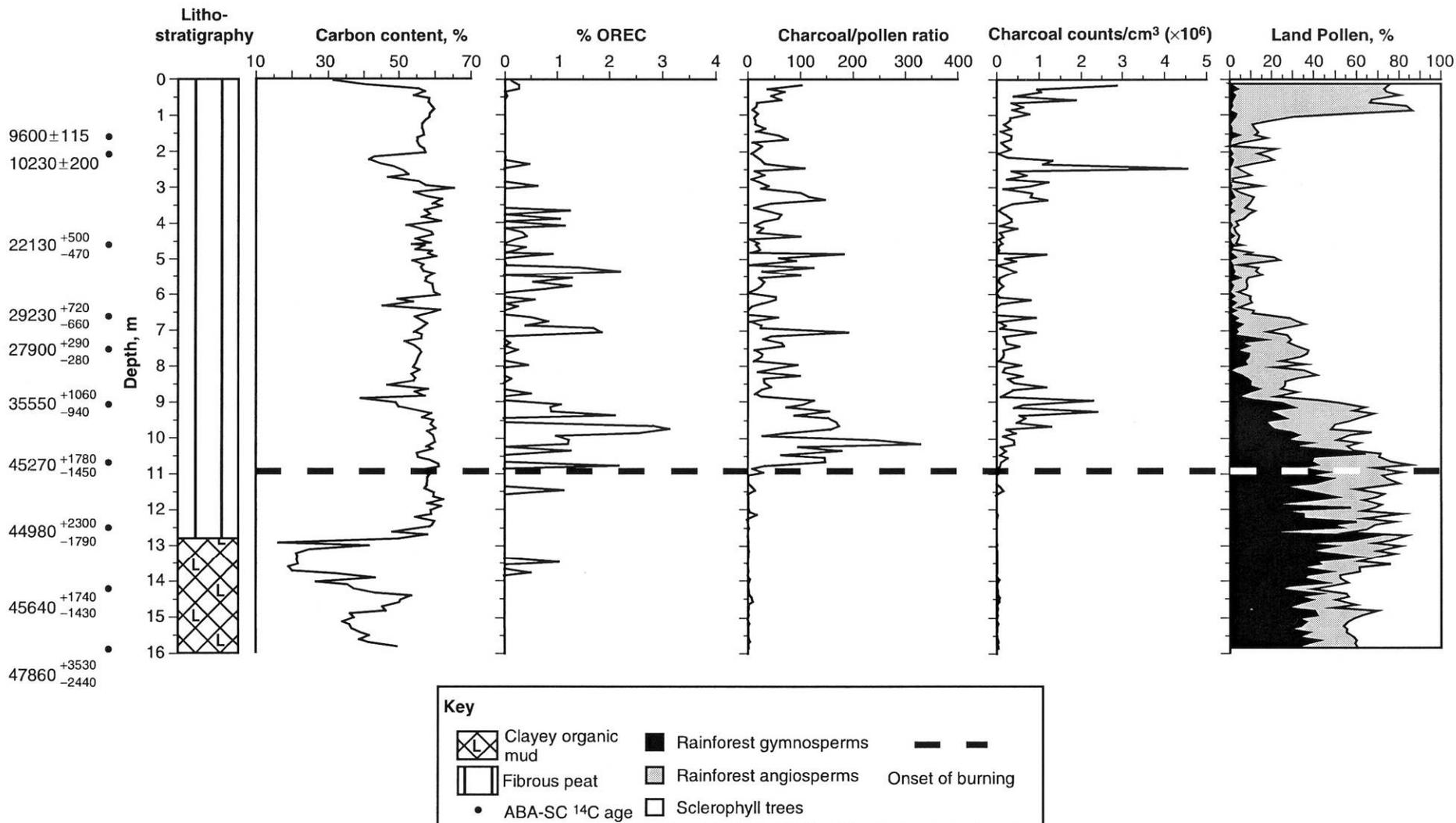
Late Quaternary fire regimes of Australasia

S.D. Mooney^{a*}, S.P. Harrison^b, P.J. Bartlein^c, A.-L. Daniiau^d, J. Stevenson^e, K.C. Brownlie^f, S. Buckman^f, M. Cupper^g, J. Luly^h, M. Black^a, E. Colhounⁱ, D. D'Costa^j, J. Dodson^k, S. Haberle^e, G.S. Hope^e, P. Kershaw^l, C. Kenyon^m, M. McKenzie^l, N. Williamsⁿ

1. People and fire in Australia...







Turney *et al.* (2001) Redating the onset of burning at Lynch's Crater (North Queensland): implications for human settlement in Australia. *J. Quat. Sci.* 16(8): 767-771.

Impacts associated with fire?

Sensitivity of the Australian Monsoon to insolation and vegetation: Implications for human impact on continental moisture balance

Gifford Miller* } Institute of Arctic and Alpine Research and Department of Geological Sciences, University of Colorado,
Jennifer Mangan* } Boulder, Colorado 80309, USA
David Pollard* }
Starley Thompson* } National Center for Atmospheric Research, Boulder, Colorado 80305, USA
Benjamin Felzer* }
John Magee } Department of Earth and Marine Sciences, Australian National University, Canberra, ACT 0200, Australia

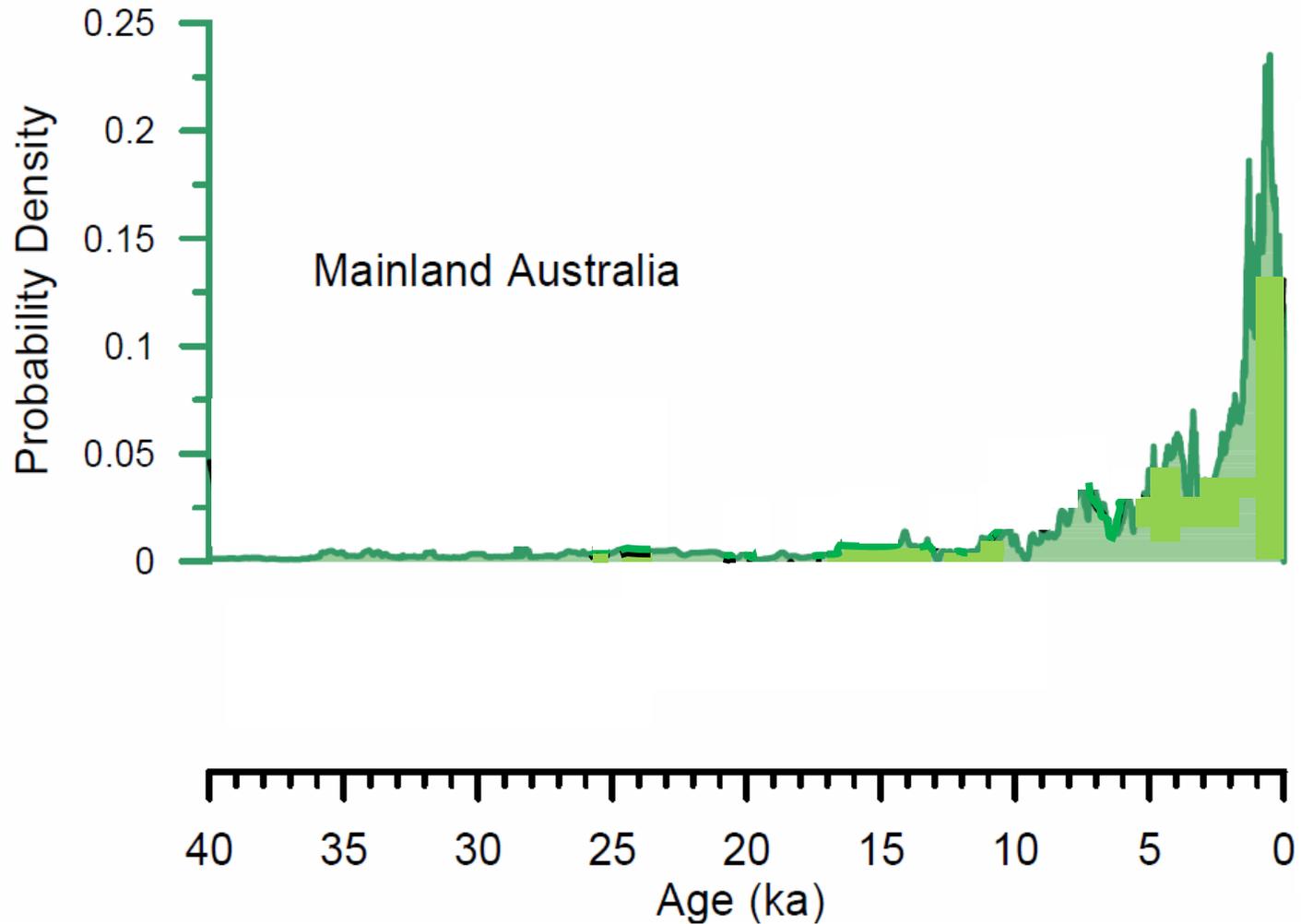
ABSTRACT

General circulation model experiments test the geologically based correlation of high monsoon rainfall over interior Australia with Northern Hemisphere insolation and evaluate the sensitivity of the Australian Monsoon to ecosystem change. Our results suggest that Northern Hemisphere insolation control on the intensity of the Siberian High, rather than summer insolation over the Australian continent, determines the strength of the Australian Monsoon on millennial time scales, unlike a classic monsoon regime. Additional simulations show that the penetration of monsoon moisture into the interior is sensitive to biosphere-atmosphere feedbacks linked to vegetation type and soil properties. This sensitivity offers a resolution to the observed failure of the Australian Monsoon to penetrate the interior in the Holocene. Postulated regular burning practiced by early humans may have converted a tree-shrub-grassland mosaic across the semiarid zone to the modern desert scrub, thereby weakening biospheric feedbacks and resulting in long-term desertification of the continent.

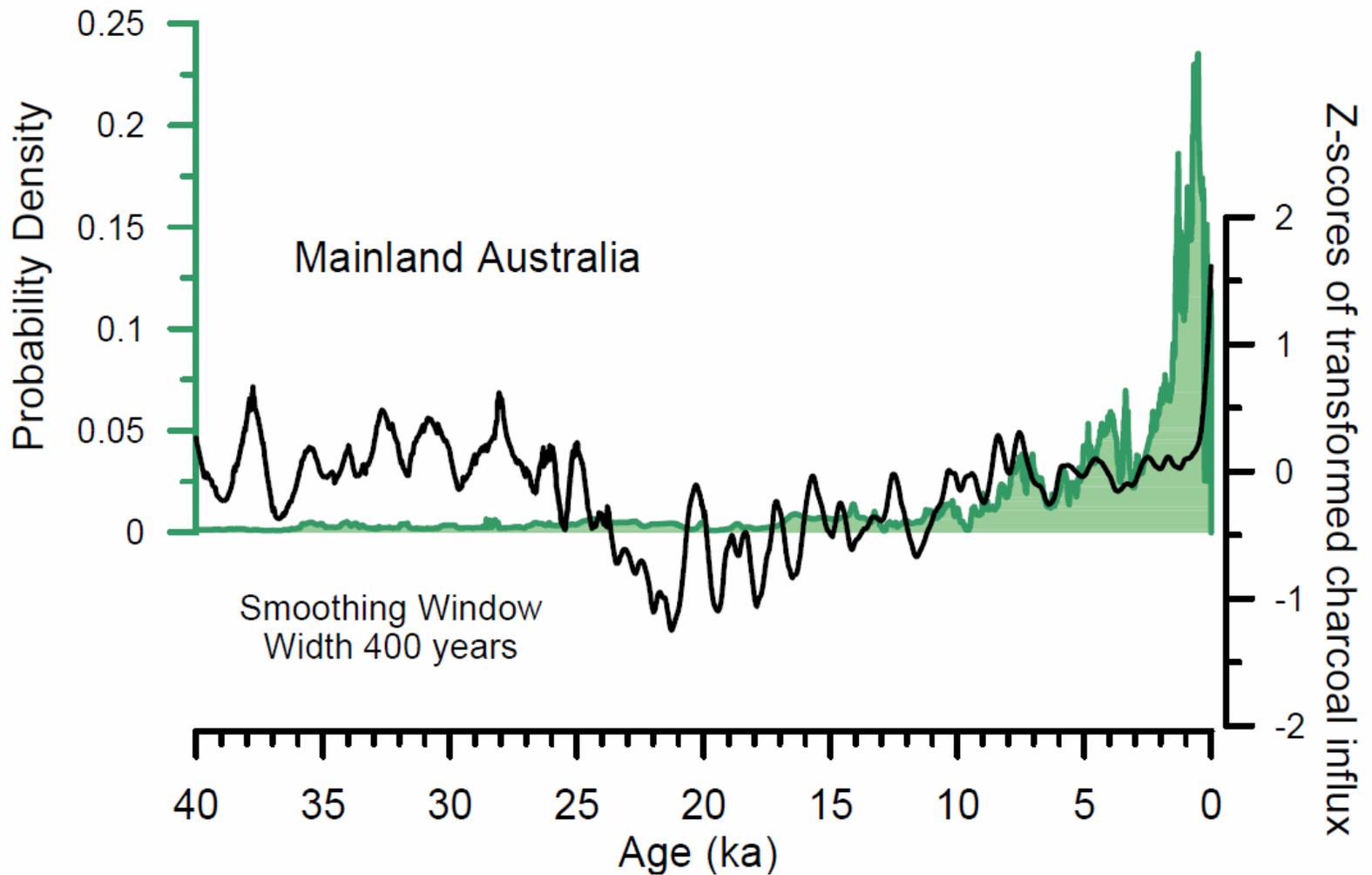
Keywords: Australia, monsoon, human, paleoclimate, climate models, biomass burning.

the east coast of Africa to the western Pacific (Hastenrath, 1987). Migration of the ITCZ onto northern Australia during the austral summer is, in this case, not the consequence of a classical pressure differential over Australia, but of the outpouring of cold air from Asia. The intensity of the Siberian High, and consequently the magnitude of southward displacement of the ITCZ, is modulated on millennial time scales by systematic variations in solar insolation over Asia. The Siberian High is intensified and outflow is strongest during DJF insolation minima, whereas the Siberian High is weakest and outflow is reduced during DJF insolation maxima. Systematic changes in the intensity of the Siberian High are a plau-

Geology (2005) 33(1): 65-68.



Archaeol data from Smith, Williams, Turney and Cupper (2008) Human—environment interactions in Australian drylands: exploratory time-series analysis of archaeological records. *The Holocene* 18, 389–401.



Archaeol data from Smith, Williams, Turney and Cupper (2008) Human—environment interactions in Australian drylands: exploratory time-series analysis of archaeological records. *The Holocene* 18, 389–401.

Ideas about fire and people in Australia...



“we see this country in the pure State of Nature, the Industry of Man has had nothing to do with any part of it”

James Cook

Captain Cook

Ideas about fire and people in Australia...

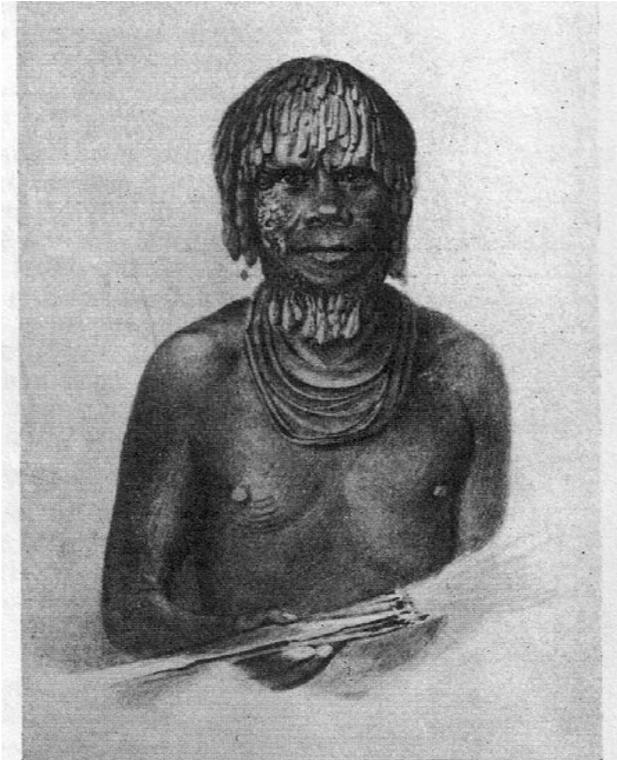
FIRE-STICK FARMING

By RHYS JONES

Research Fellow, Department of Prehistory, Australian National University, Canberra, A.C.T.

IN recent years there has been increasing interest in the effect of man on the Australian environment. Forests have been bulldozed, swamps drained, heaths sown with trace elements, beaches chewed up, and the litter of the mid-twentieth century spread everywhere. That this is deeply affecting the countryside is obvious to all and causes concern to some. G. P. Marsh saw the same thing happening to the face of America during the last century, and doubtless the Roman intelligentsia of the rich provinces of North Africa gave the matter some thought as the wheatfields around their villas turned slowly into desert.

In most discussions a contrast is made between a “natural” environment as opposed to an “artificial” one. We imply that the former represents the climax without the effects of man, and as examples of it we think of bushland around our cities, the national parks, and remote areas. We imagine that the country seen by the first colonists before they ringbarked their first tree was “natural”. But was it?



Mannalargenna, an Aborigine from the east coast of Tasmania, holding a burning fire-stick. [Watercolour painting by T. Bock, in the National Library, Canberra.]



Portrays Aboriginal people as living in *socialised* landscapes (cf. *Terra nullius*).

Portrays fire as ubiquitous, frequent, low intensity, small, within a well-defined season. (And fuel loads are low.) (And vegetation is more open.)

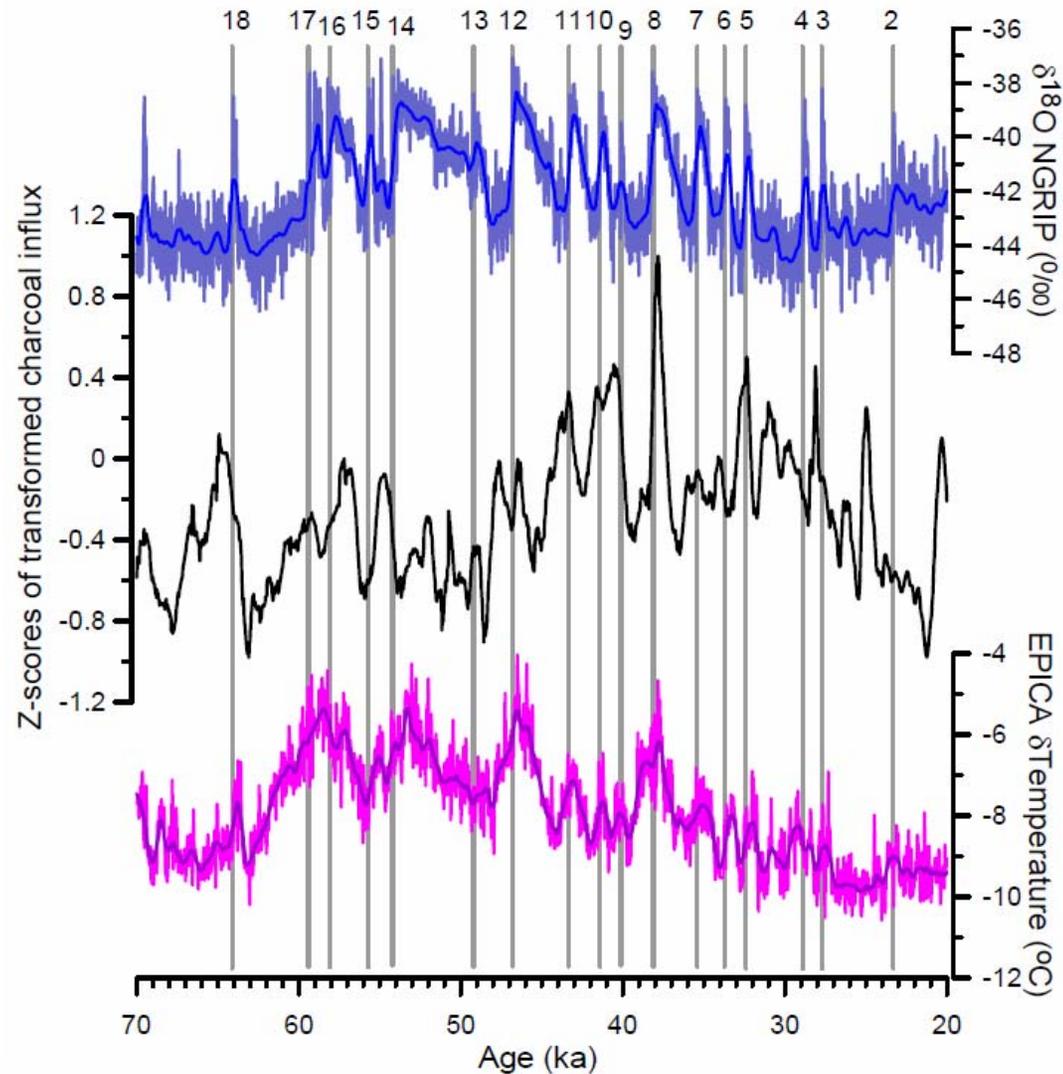
Warra warra wai*

*the first words spoken to white explorers on the east coast of Australia by a Gweeagal/Gwygal man



*loosely translated as “bugger off”

2. Climate and fire in Australia...



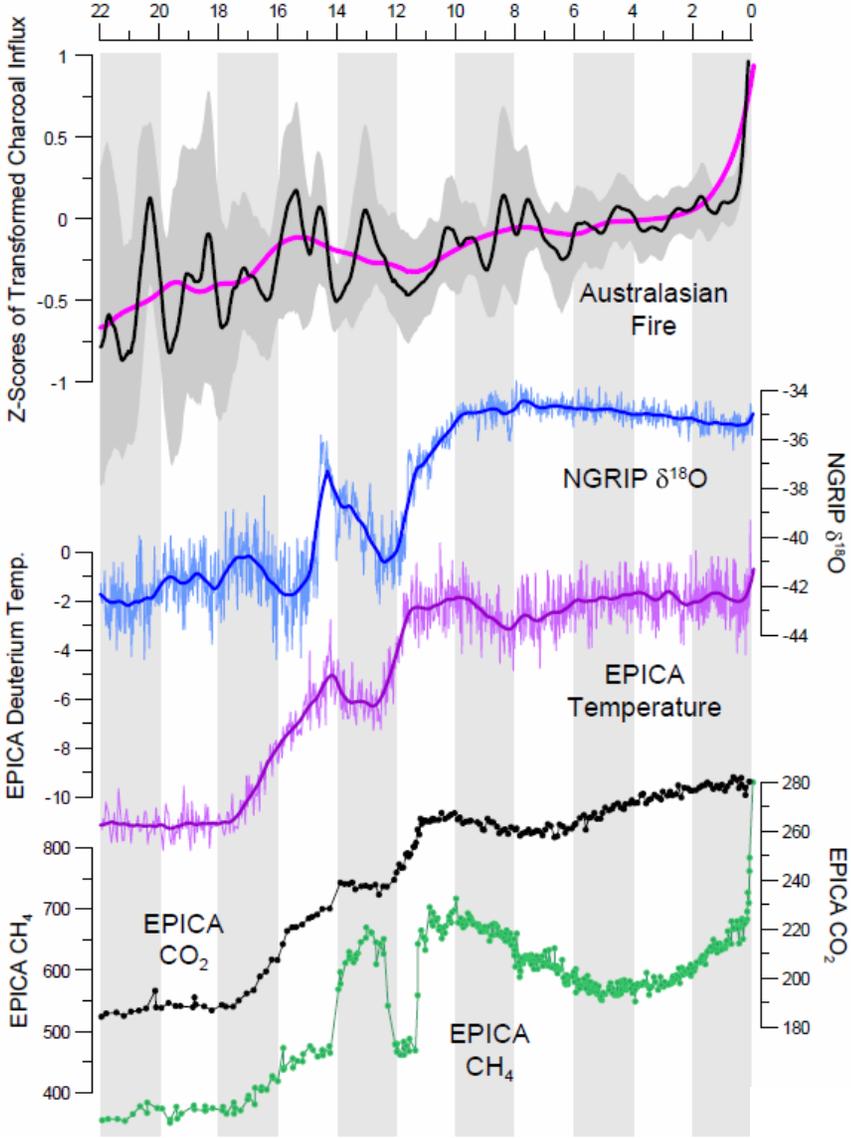
Charcoal data are summarized using a lowess curve with a 400-year half-window width (black).

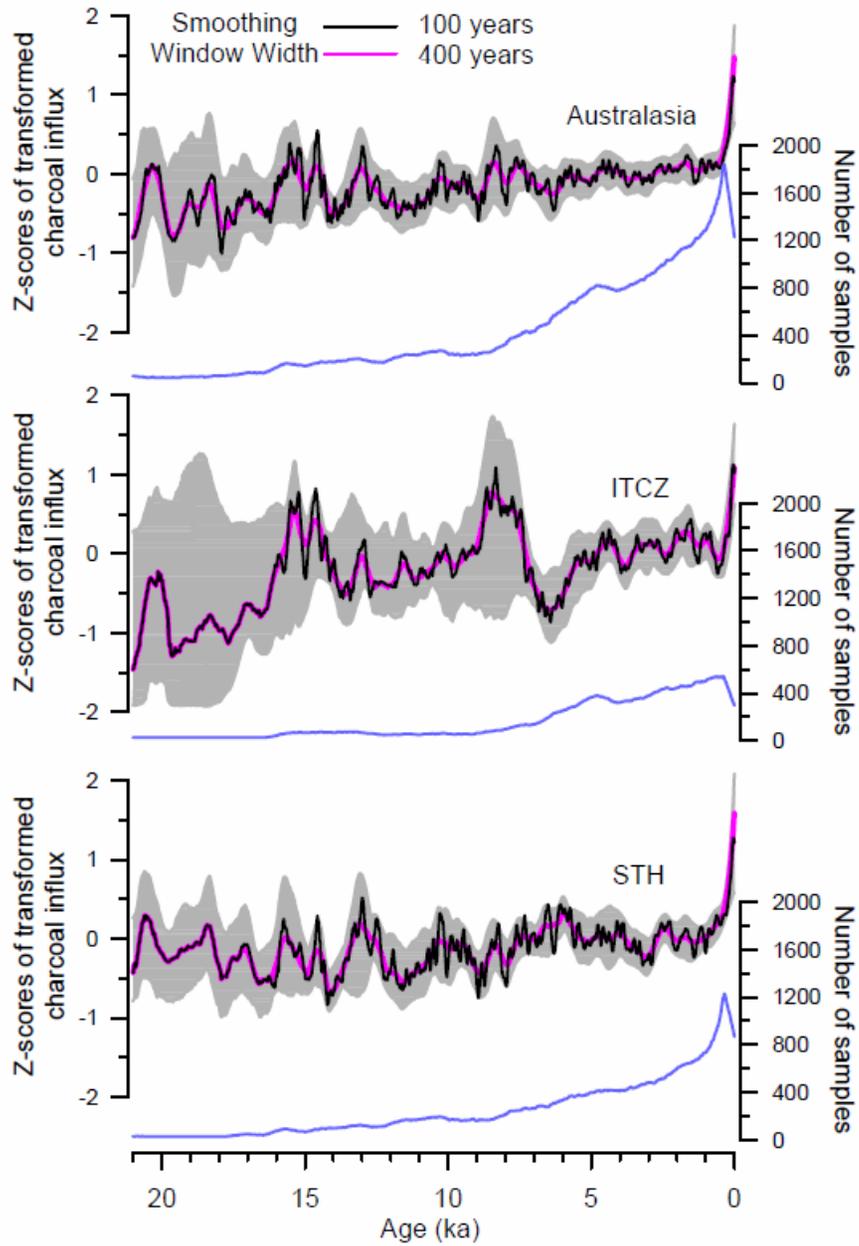
Late Quaternary fire regimes of Australasia

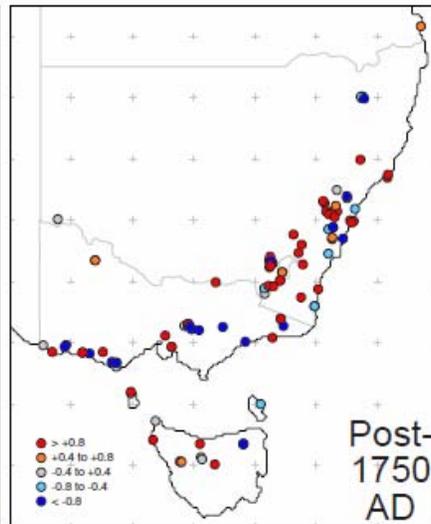
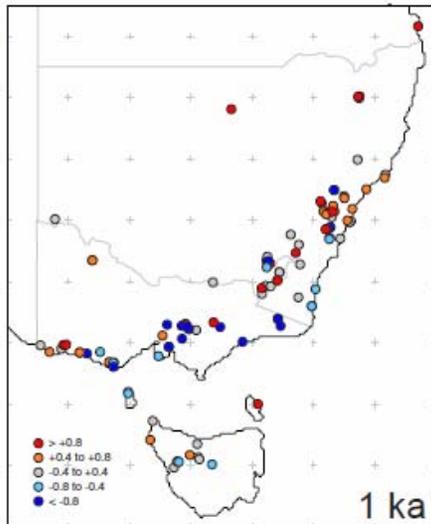
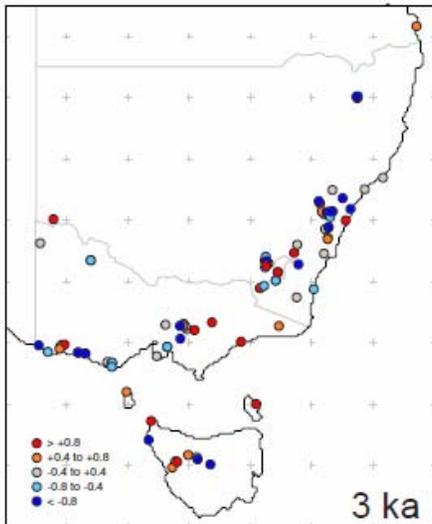
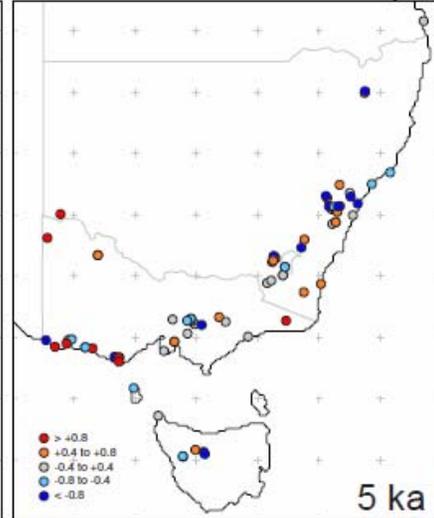
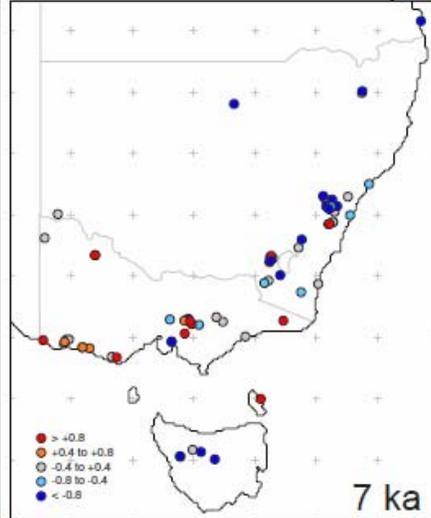
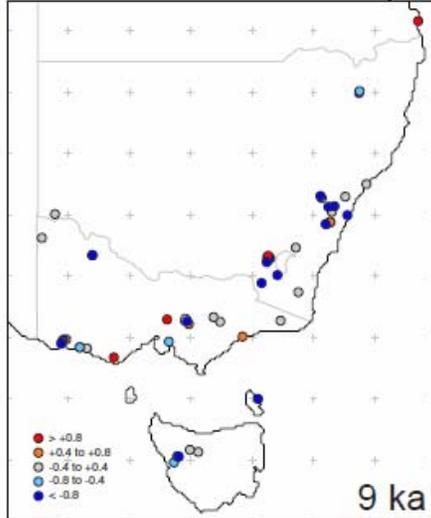
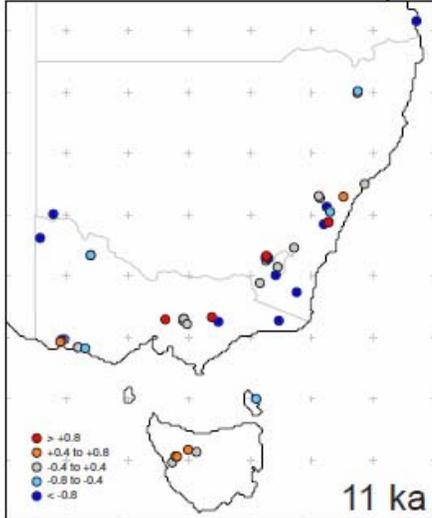
S.D. Mooney^{a,*}, S.P. Harrison^b, P.J. Bartlein^c, A.-L. Daniau^d, J. Stevenson^e, K.C. Brownlie^f, S. Buckman^f, M. Cupper^g, J. Luly^h, M. Black^a, E. Colhounⁱ, D. D'Costa^j, J. Dodson^k, S. Haberle^e, G.S. Hope^e, P. Kershaw^l, C. Kenyon^m, M. McKenzie^l, N. Williamsⁿ

Quaternary Science Reviews 30 (2011) 28–46

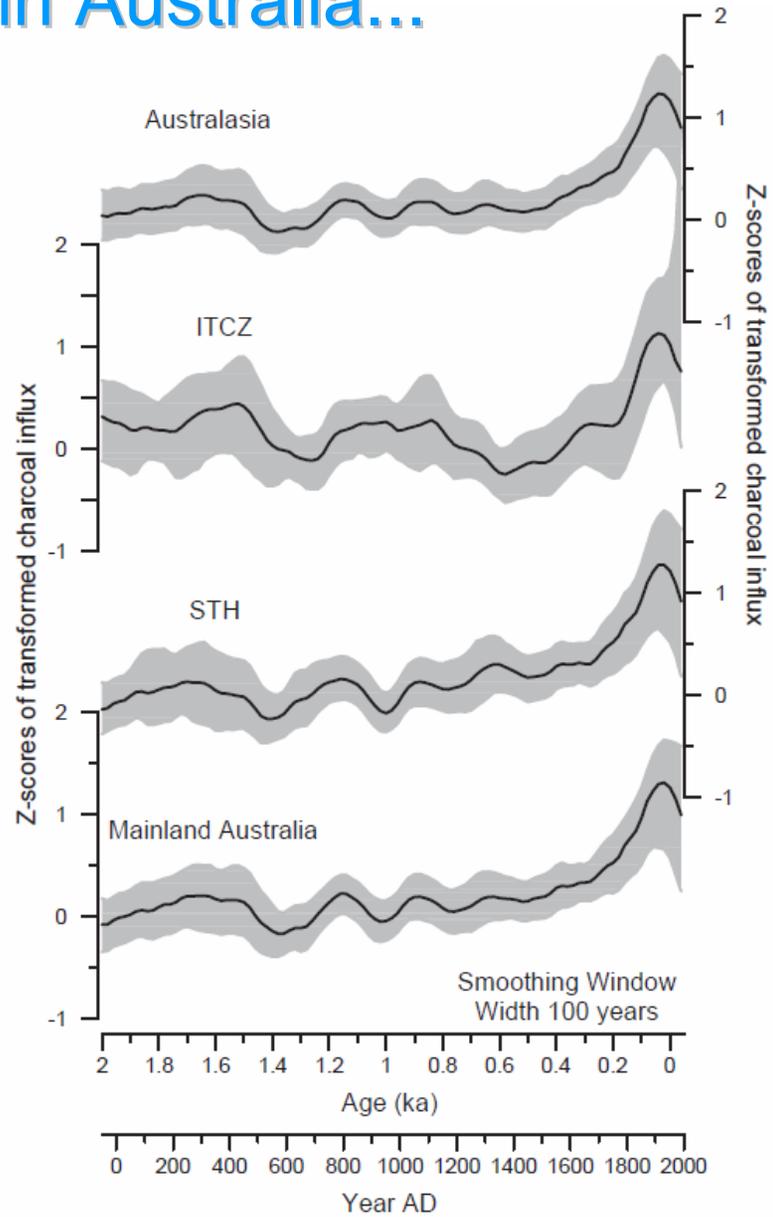
2. Climate and fire in Australia...







People and fire in Australia...



Burn-off theory up in smoke

The popular notion that Aborigines carried out widespread burning of the Australian landscape is a myth, research shows. Scientists have analysed charcoal results from more than 220 sites dating back 70,000 years.

► News – Page 3

The Sydney Morning Herald

December 6, 2010

Cold water is poured on Aboriginal burnoff culture

Deborah Smith
SCIENCE EDITOR

THE popular notion that Aborigines carried out widespread burning of the Australian landscape is a myth, research shows.

A study of charcoal records has found that the arrival of the first Australians about 50,000 years ago did not result in significantly greater fire activity across the continent.

An international team of scientists led by Scott Mooney, of the University of NSW, analysed results from more than 220 sites in Australasia dating back 70,000 years, the most comprehensive survey so far.

Dr Mooney said their findings challenged a widely held view that

frequent use of fire by Aborigines had had a big impact on vegetation and the environment in prehistoric times. Instead, it was the arrival of European colonists more than 200 years ago that led to a substantial increase in fires, the study showed.

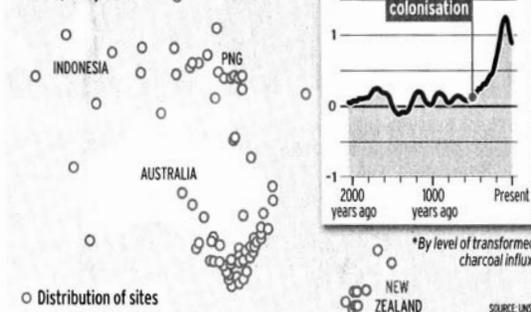
"We've put the firestick in the wrong hands," Dr Mooney said. "The firestick shouldn't be in Aboriginal people's hands. It's really a European thing."

He said there were often calls after big, destructive bushfires for authorities to carry out Aboriginal-like burnoffs – frequent, low intensity fires – to manage the landscape and prevent further conflagrations.

But this was not based on evidence. The new research

BURNING ISSUE

A study of 223 charcoal records dating back 70,000 years



showed that climate, not prehistoric people, had had the biggest impact on fire in Australia.

The message was that "we're

really going to have problems in the future", he said, referring to rising global temperatures.

Australia has some of the most

'We've put the firestick in the wrong hands.'

Dr Scott Mooney

fire prone landscapes on earth. To help determine the continent's fire history, researchers have drilled bore holes into old swamp sediments.

They then worked out the charcoal content in different layers, radiocarbon dating them to determine their age.

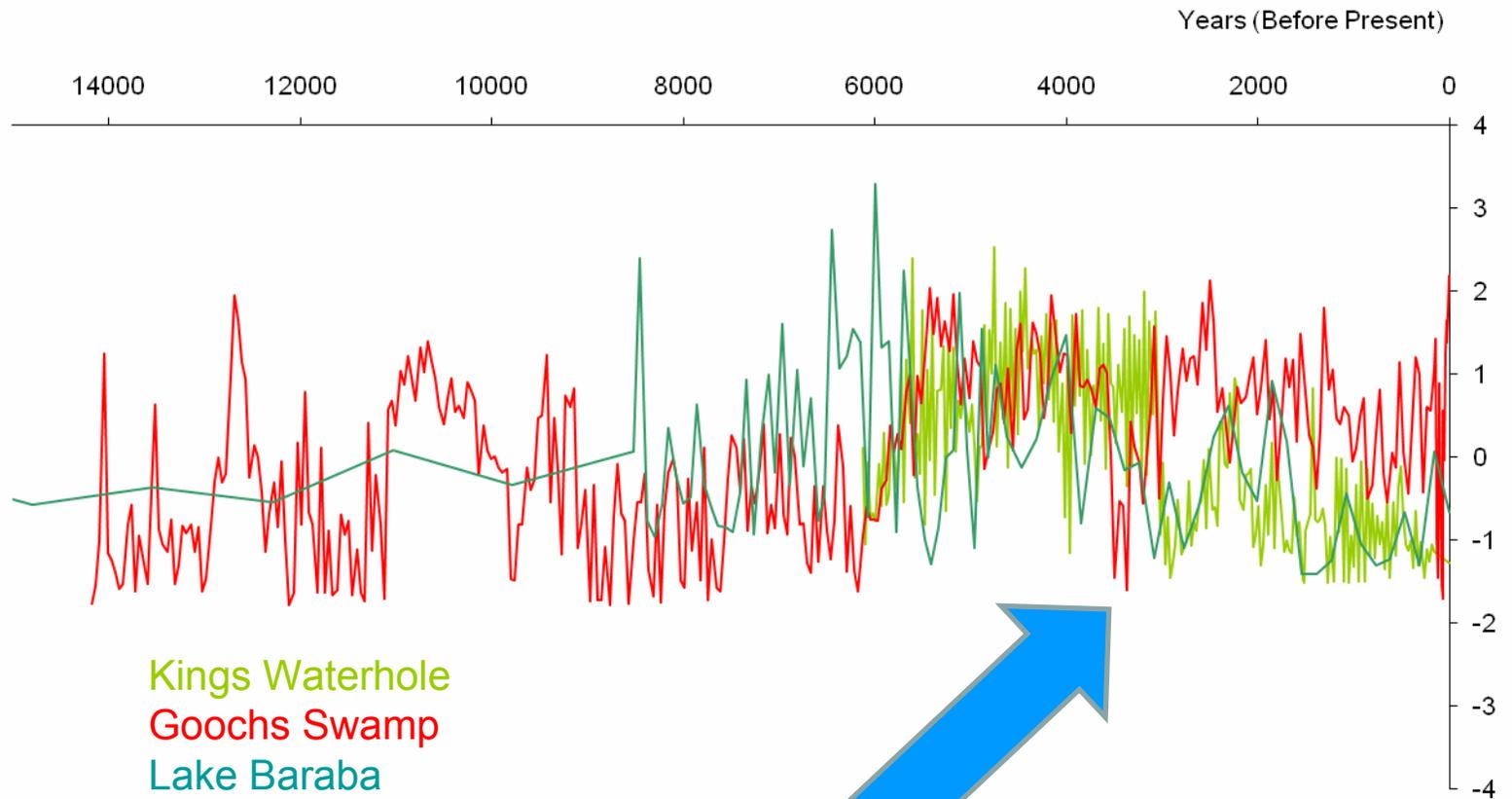
Dr Mooney and his team of 18 scientists analysed results from 223 sites in Australia, New Zealand, Papua New Guinea and

some islands in the western Pacific. Their study, published in the journal *Quaternary Science Reviews*, shows that bushfire activity was high from about 70,000 to 28,000 years ago.

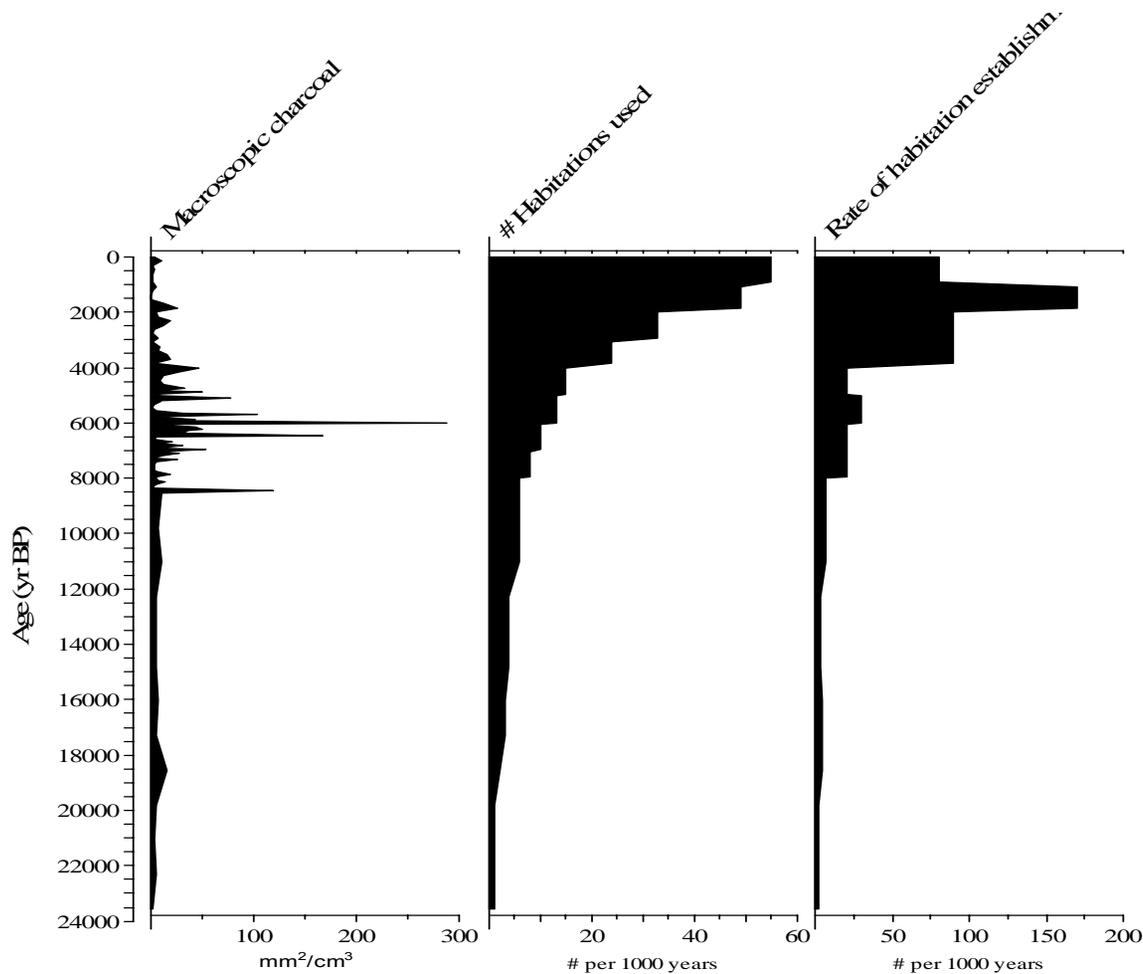
It decreased until about 18,000 years ago, around the time of the last glacial maximum, and then increased again, a pattern consistent with shifts between warm and cool climatic conditions.

"We found no evidence of a change in fire regimes at a continental scale at the time of Aboriginal colonisation," Dr Mooney said. During the past 2000 years, burning activity was "remarkably flat, except for the pronounced increase in fire in the past 200 years".

Back to Sydney....

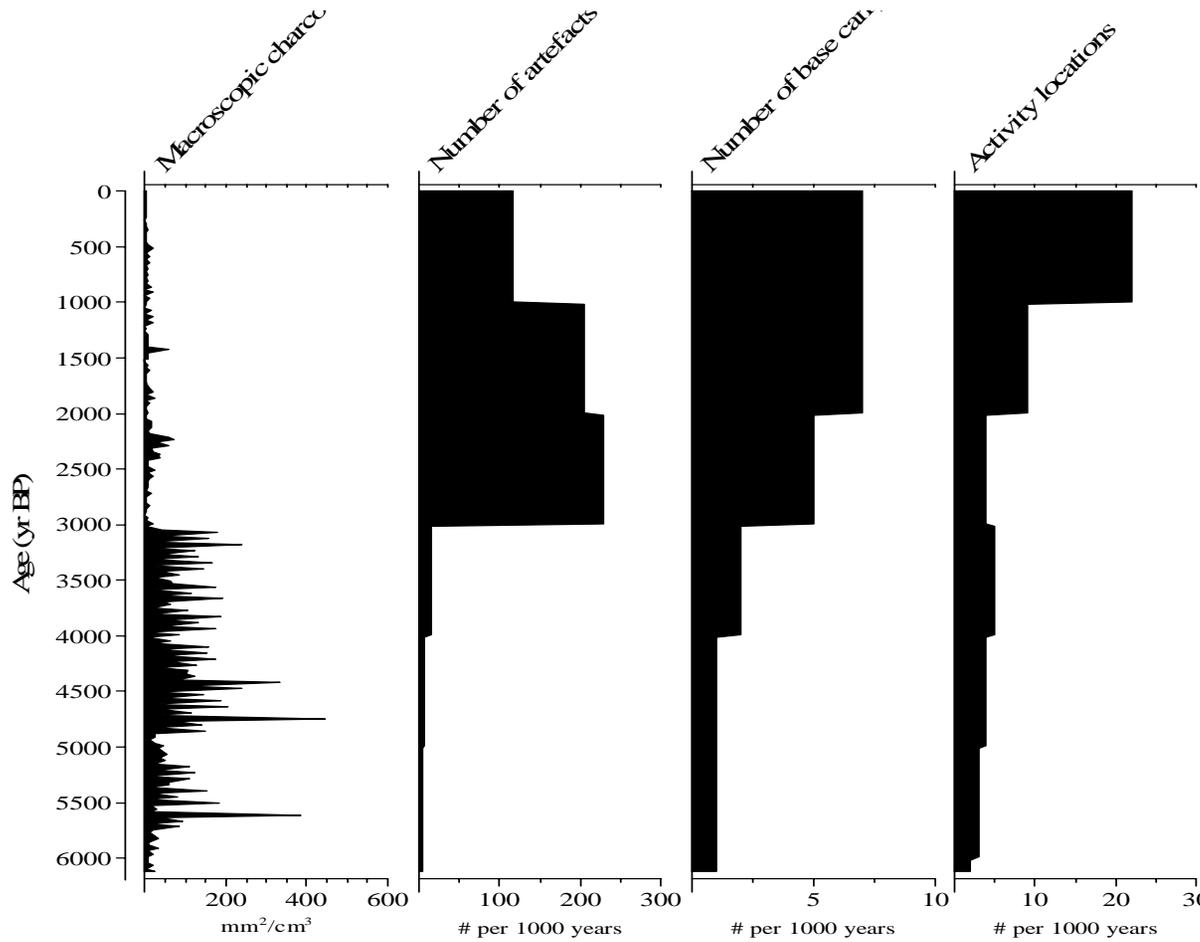


Comparison of Lake Baraba charcoal with regional archaeological data*



*Archaeological data from the NSW South Coast and hinterland (Attenbrow, 2004)

Comparison of Kings Waterhole Swamp charcoal with Upper Mangrove Creek archaeological sequences



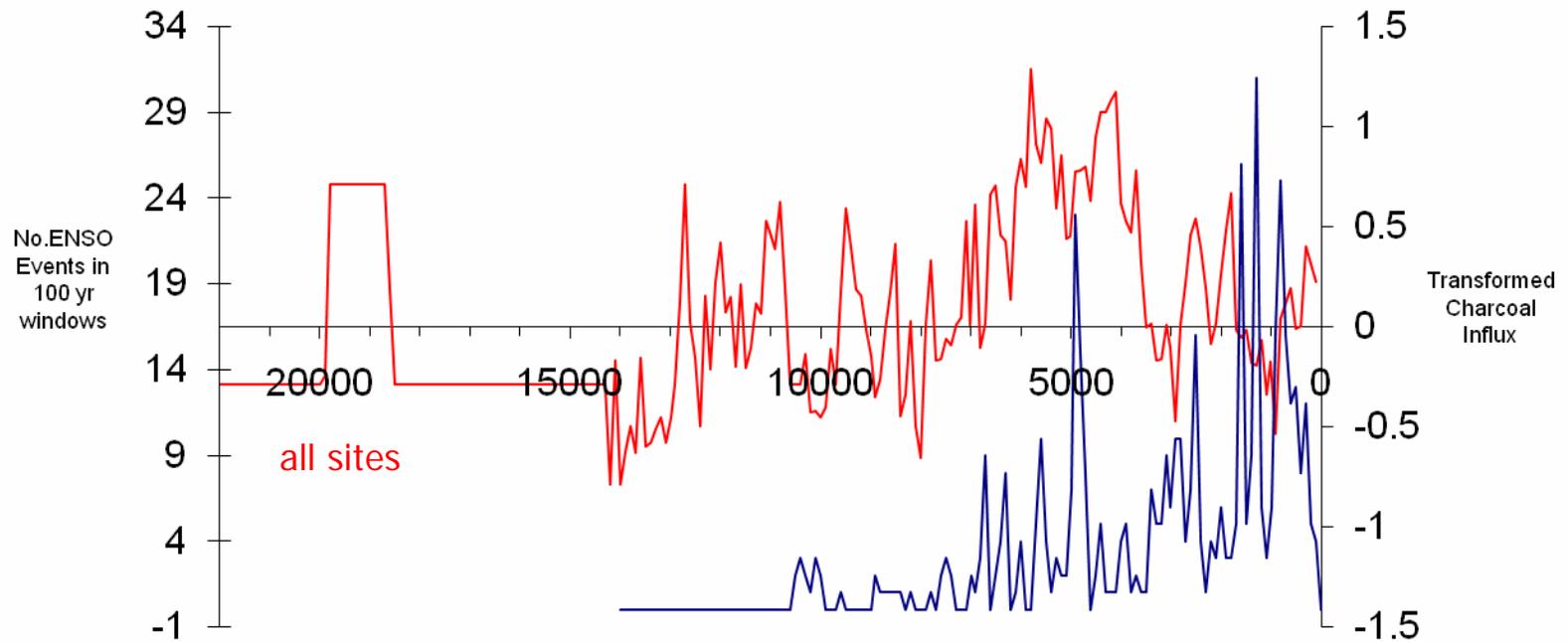
A Comparison of Charcoal and Archaeological Information to Address the Influences on Holocene Fire Activity in the Sydney Basin

S. D. MOONEY, M. WEBB & V. ATTENBROW, *University of New South Wales, Australia; University of New South Wales, Australia; Australian Museum, Sydney, Australia*

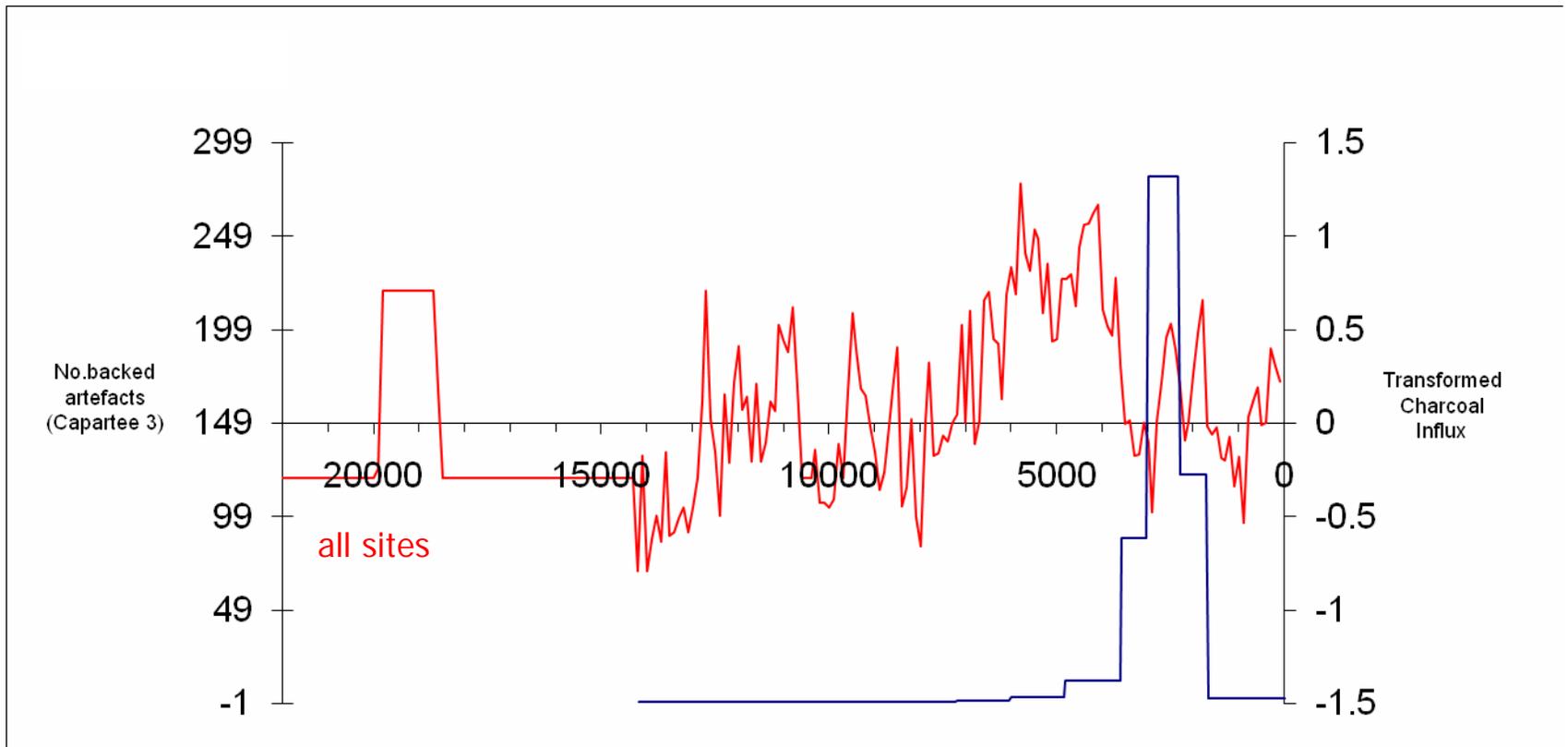
Australian Geographer
38 (2007), pp 177-194.

*Archaeological data from the Upper Mangrove Creek catchment, ~30 km away

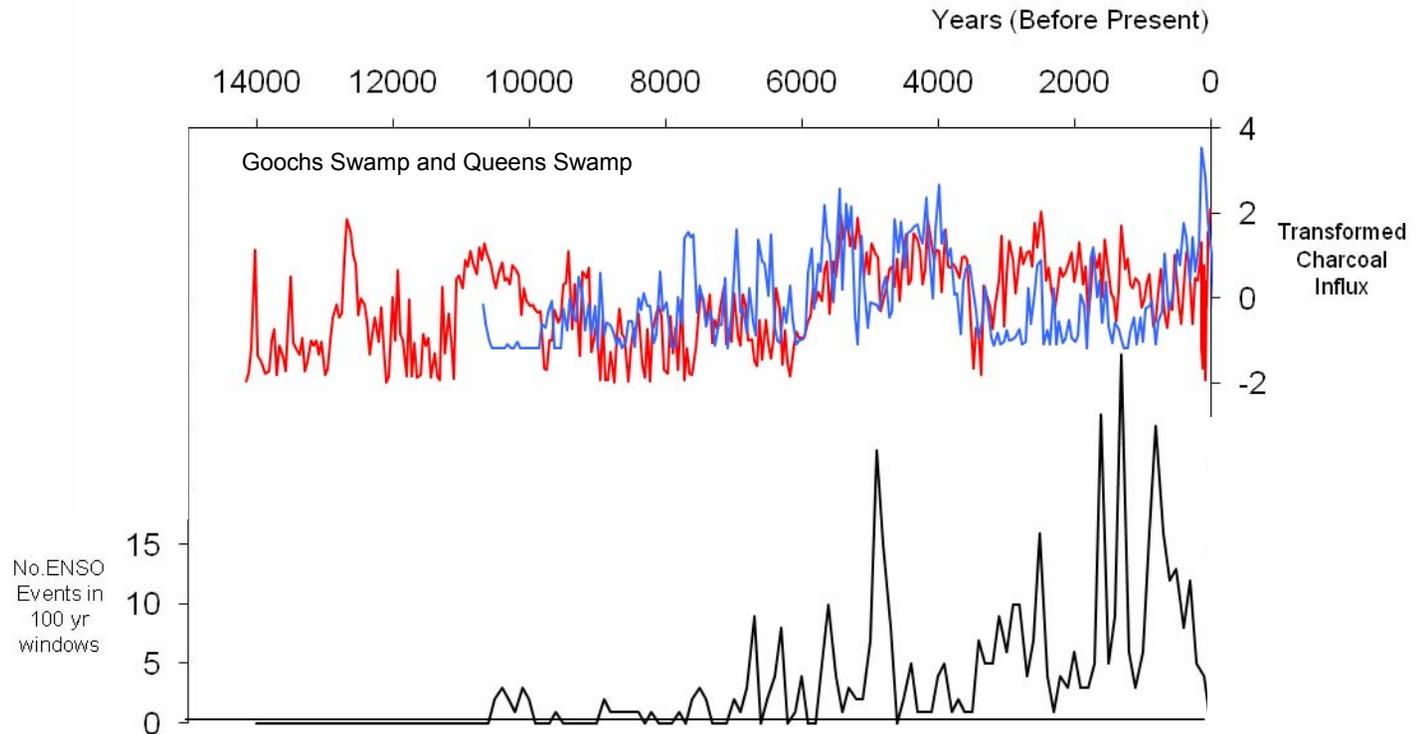
What is the primary driver of past fire at a regional scale? Climate?



What is the primary driver of past fire at a regional scale? People?



What is the primary driver of past fire in eastern Australia? Climate and People!



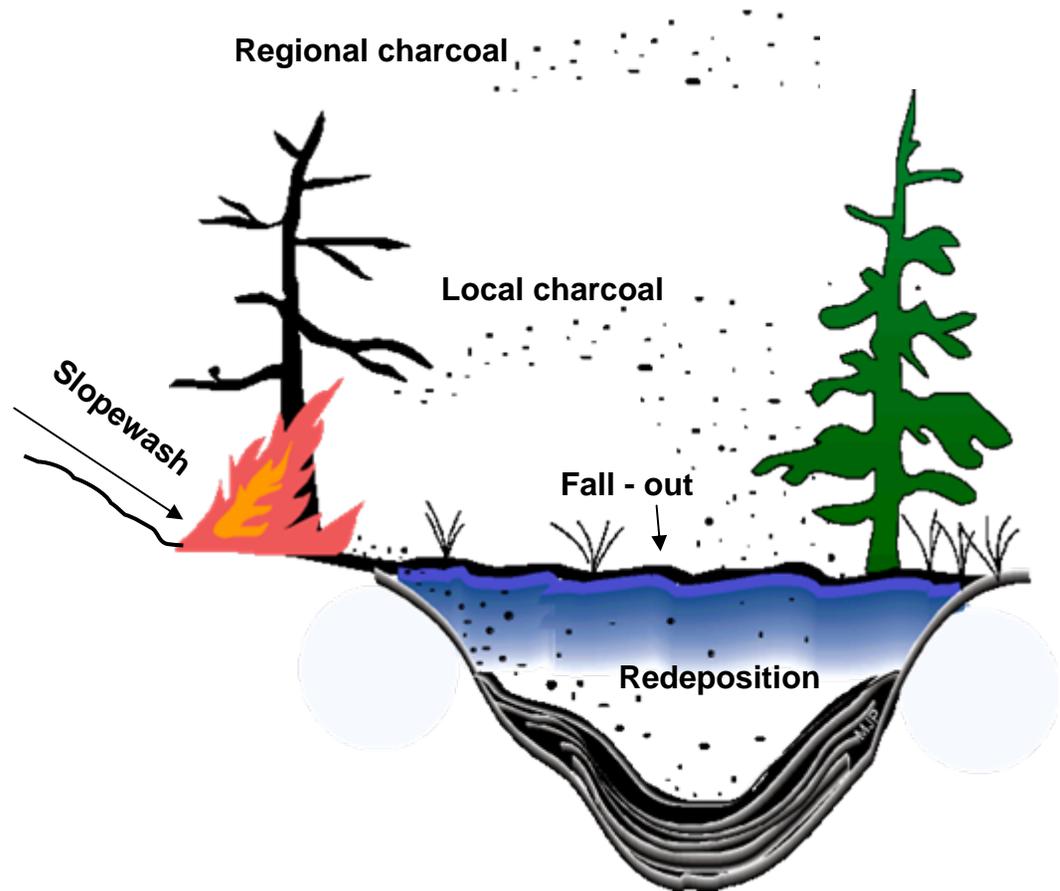
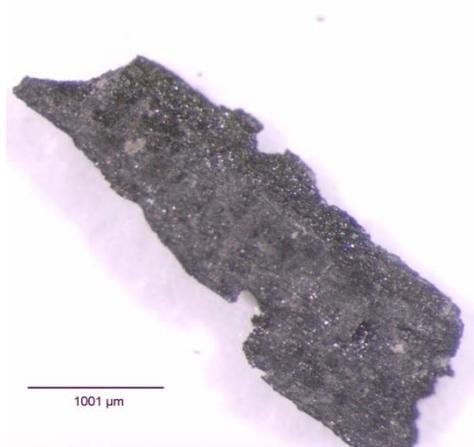


- this work provides a long perspective on fire activity in the Sydney Basin (against a broader region);
- fire was variable through time and is driven by climate at continent-wide scales;
- Aboriginal fire is visible at a few sites... probably related to resources?
- Holocene fire activity in the Sydney Basin appears to result from an interplay of natural and anthropogenic forcing (=complicated!);
- the work demonstrates very large changes in fire in the post-European period (peaking in the C19th);
- the links between fire, humans and climate change suggest future increases in fire in our landscapes.

Acknowledgements

- The Global Palaeofire Working Group is *many* people...
 - <http://www.bridge.bris.ac.uk/projects/QUEST> IGBP Global Palaeofire WG
- The Australian component of the GPWG is QUAVIDA was a working group of the ARC-NZ Network for Vegetation Function and in the UK, QUEST.
 - <http://www.bridge.bris.ac.uk/projects/quavida>
- The Australian Charcoal Database was an OZPACS project funded by the ARC Environmental Futures Network.
 - <http://www.aqua.org.au/Archive/OZPACS/OZPACS.html>
- Special thanks to **Sandy Harrison**, Janelle Stevenson, Patrick Bartlein, Val Attenbrow and Allan Williams for **diagrams, methods, discussion...**
- UNSW Faculty of Science for funding.
- NSW NPWS for permission to work in their reserves.

The tools: 3. sedimentary charcoal records



Some background III

At the May 2007 NCC conference (*Bushfire in a heating world*) I presented...

Case studies of Holocene fire activity in the Sydney Basin: natural, anthropogenic or something much more complicated?

which described:

- fire activity was variable across space and time;

and concluded:

- broad generalisations about Aboriginal use of fire were premature;
 - depended on the prevailing climate, thresholds in population size and resources available at individual locations.
 - 'fire stick farming' may only be as old as current patterns of seasonality;
- fire was frequent in some places since the mid-to-late Holocene (last ~5,000 years).