

I N D E X

Note: Illustrations are shown with either bold page numbers or as Plates. Page numbers ending in 't' refer to tables.

- Aboriginal burning
 and extinctions 43–4, 51
 and vegetation levels 124–6, 142, 191–3
 evidence from charcoal concentrations 92–3
 Holocene 144
 impact on Australian environment 142–4
 reasons for use 143–4
 to increase harvest of large mammals 145–6
see also fire
- Aboriginal hunting
 and extinctions 47–9, 97, 228
 cessation of, impact on mammal populations 162–5
 Holocene 138
 of cats, providing protection for native mammals 205–6
 of devils 161–2
 of dingoes 150
 of kangaroos 145–6
 of thylacines 159–61
 weapons used 47, 48, 160–1
- Aboriginal people
 agricultural practices 141
 and environmental change 132–47
 and extinctions 38, 39
 as top predator 234
 care of camp dingoes 151
 competition with dingoes for food 153
 cooperative behaviour 146
 effect of sea level rise on 134–5
 food festivals 139–40
 impact of Last Glacial Maximum on 132–4
 impact on wild dingo population 152–3
 intensification of resource use 140–1
 occupation of low productivity habitats 140
 oral traditions linked to extinct megafauna 70–1
 population growth 136–7, 142
 relationship with dingoes 150–3
 rock painting 69–70, 135, 139, 155, 156, 157, 160, 161
 sedentary and permanent occupation 138–9
 social change 139–41
 social groups 139
 tool development 160–1
 Holocene 137–8, 141–2
 use of animal and plant species, Holocene 138
 use of extinct megafauna 71–2
- Acacia* 9, 83, 117
 spiny-foilage of juvenile arid-zone acacia Plate 13
- Acacia estrophiolata* 117
- Acacia nilotica* 128
- Acacia peuce* 117, 127, 128
 height dimorphism Plate 14
- Acacia pickardii* 118
- Acacia victoriae* 128
- Accelerator Mass Spectrometry (AMS) 56
- accidents of history 233–5
- Aepyprymnus rufescens* 164, 176, 200
- African megaherbivores, impact on vegetation 116
- agricultural practices, Aboriginal people 141
- Agrotis infusa* 139
- Allens Cave, Nullarbor Plain 61, 134
- Allosyncarpia ternata* forest 95
- Angophora* 83
- Antarctic faunas 6, 7
- Antarctic marsupials, cross into Australia 7–8
- Antechinus* 29
- Antechinus putes* 99
- anti-browser plant architecture 117–18, Plate 12
- anti-browsing defences 116–19, 127–8
- antilopine wallaroos, Kimberley grassland Plate 11
- Araucaria* 83
- Araucariaceae 5
- arboreal marsupials 99
- archaeological invisibility of massive killings 47–9, 111
- archaeological sites for human occupation 58–61, 59t
- arid zone, pollen core sample analysis 84–5
- aridity
 and megafauna extinctions 37, 38, 39–42
 under glacial conditions 78
- Arnhem Land paintings 69–70, 146, 155
- articulated skeletal remains 62–3
- Asteraceae 122
- atmospheric carbon dioxide 77, 81–2, 89, 123
- ausktribosphenids 4–5
- Australian ecosystems, Aboriginal people impact on 132–47
- Australian environment
 mammal fauna vulnerability to 231–2
 unsuitability of non-flying mammals to 232
- Australian mammals
 history, timeline x
 number of extinctions 3
- Australian marsupials
 origins and evolution 6–12
 phylogeny 29
 Pleistocene dwarfing 34–5
- Australian prehistory
 arrival 57–61
 dispersion 61–2
- Australian rodents *see* rodents, native
- Australian Small Tool Tradition 141
- Australian Wildlife Conservancy (AWC) 224
- Australo-Papuan region, marsupial diversity 3
- Balmoral Beach, Sydney 144
- Banda Sea marine sediments 84, 88, 92
- bandicoots 29, 172

- extinct species 178–9
 foraging behaviour, ecological implications 185
 spreading of fungal spores 182, 183
 toxoplasmosis in 189
Banksia 83, 144
 basalt plains mouse 181
 Bassian Plain 10, 11, 85
 pollen core sample analysis 86–7
 bats 28
 origin and evolution 13–14
 Bennett's tree kangaroo 164
Bettongia 182
Bettongia lesueur 164, Plate 20
Bettongia penicillata 164
Bettongia pusilla 34, 176
 bettongs 164, 165, 172, 176, 208, 221
 foraging behaviour, ecological implications 185
 truffle-eating 182, Plate 36
 bilbies 29, 164, 165, 178, 208, 209, 211
 burrowing behaviour, ecological implications 185
 decline in range 173
 fire impact on ecology 192–3
 foraging behaviour, ecological implications 185
 foxes impact on 200
 biological control of predators 224–5, 226
 birds
 ground-nesting 35
 herbivorous 25–6
 black-footed rock-wallaby 201–2
 black-striped wallaby 138
 blitzkrieg hypothesis 44–5
 criticisms 47–9, 50
 body mass
 and risk of extinction 104
 and role of carnivorous mammals 32
 estimation difficulties 30–1
 relationship with home range size 101
 reptiles 32
 body size
 and extinction pattern, European Australia 168–70
 and Pleistocene mammal extinctions 33–5
 increase in 9
 Pleistocene mammals comparison 31
 prey species 222–3
 bogong moths 139
Bolna paulae 99
Borongaboodie hatcheri 27, 33
 bridled nailtail wallaby 200, Plate 38
 broad-faced potoroo 176, Plate 22
 browser extinction 101
 evolutionary impact on plants 127–8
 browsers 115–16, 127
 plant defences against 116–19, 127
 brush wallaby 164
 brushtail bettong *see* woylie
 through human impact 92–3
 variation in 93–4
 chemical defences by plants 116, 118
 chenopod shrublands 122, 126
 chenopods 9, 22, 84, 85, 87
 chuditch 179, 192, 201
 decline in range 173
Citrus glauca 117
 climate
 Cretaceous 5
 Eocene 5
 ice age 76–81
 climate change 223
 and vegetation 81–9, 98–101
 Eocene 8–9
 Pleistocene 11–12, 37, 39–42
 climate-driven extinctions 37–8, 39–42, 50, 96–7
 criticisms 41–2
 climate variability
 ice ages 80–1
 on ENSO timescales 81, 94, 95
 climate warming, and sea level rise 135
 Cloggs Cave 68, 155
 coastal habitats 135–6
 competitive killing 218–19
 conilurine rodents 13, 200, 201, 215
 reproductive rates 232–3
Conilurus albipes Plate 30
 continental dust 78, 79
 coyotes, suppression of feral cats 220
 crescent nailtail wallaby 177, Plate 24
 Cretaceous climate 5
 Cretaceous mammals 4–5
 critical-weight-range mammals
 collapses of, Morton's hypothesis 232
 declines and extinctions, model 222–7
 importance of neutralising predators on 223–4
 predation on 204, 205, 215–16, 220, 221
 Cuddie Springs fossil site, NSW 37, 64–5, 68, 91
 debate over age of megafauna remains 64–6, 75
 cuscuses 12, 29
Cuvieronius 119
Cyanoramphus novaezelandiae erythrotis 213–14
 cycads 138

Dacrydium 128
Dacrydium guillauminii 128, 129
Dactylopsila kambuayai 34
 damper 140
 Darling Downs hopping-mouse 180
 Darwin, Charles 36
 Darwin Crater, Tasmania 84, 91, 95
 dasyurids 99
 dasyuromorph marsupials 9
Dasyurus 200
Dasyurus geoffroi 173

- Dasyurus hallucatus* 222
Dasyurus maculatus 188
 dates for earliest occupation 58–9, 59t
 contrasting dates 59, 60–1
 impact of downward displacement on dates 59–60
 dating of megafauna fossils 62–3
 criticisms 63–4
 evidence for late survival 64–72
 dating technologies 55–7
Dendrolagus 12
Dendrolagus bennettianus 164
Dendrolagus dorianus 34
Dendrolagus noibano 34
 dense and diverse ground vegetation,
 dependence on 98–9
 dense forest, dependence on 98
 desert bandicoot 178, 203, Plate 27
 desert rat-kangaroo 1–2, 2, 176, Plate 21
 habitat Plate 1
 devils 32, 234
 depiction in rock painting 157
 depiction of hunting in rock painting 161
 hunting of 161–2
 impact of thylacine extinction on 162
 mainland extinction of 153, 156
 outcompeted by dingoes 159
 see also Tasmanian devil
 Devils Lair 58, 60, 68
 dingoes 234
 as biological control agent for foxes and cats 225
 as moderate threat to cattle 225
 as threat to sheep 226–7
 bounty scheme 216–17
 control of feral goats and pigs 225
 depiction in rock painting 157
 diet 157
 ecological effects on thylacines 157–8
 ecological impact of 166
 fossil record 149
 genetic variation 148, 149
 high-density distribution 198
 history 148–50
 hunting of 150
 impact on human population size 152
 impact on kangaroo numbers 165
 need to increase numbers of 216–22, 225–6, 234
 not associated with mammal extinctions 38, 215, 219–20
 outcompeting devils 159
 outcompeting thylacines 152–3, 157–9
 persecution of 216–17, 225
 relationship with Aboriginal people 150–3
 role in folk belief 151
 spread throughout Australia 149–50
 stabilisation of kangaroo numbers 219, 225
 suppression of fox numbers 217–19, 220, 225
 transport to Australia 149
 use by Aboriginal people for hunting 150–1
Diomedea exulans 114
Diprotodon 36, 37
 dating 63, 66
Diprotodon minor 17
Diprotodon optatum 17, 21
 body mass estimation 30–1
 climate change effects 42, 101
 demographic model of overhunting 108–10, 111
 impact of Aboriginal burning on 43
 impact of rainfall decline on 40–1
 size and feeding habits 17
 diprotodons 11, 17–20, 30, 36
 diprotodonts 16, 17, 29
 disease epidemics
 and mammal extinctions/decline 188–189
 criticisms 189–91
 and megafauna extinctions 49–50
 impact on Tasmanian devils 223
 divaricate growth 118
 dodo, extinction causes 53
 Dreamtime animals, Aboriginal people's depictions of megafauna 69–72
 drier environment, Pliocene/Pleistocene 9–10
Dromaius novaehollandiae 63
Dromiciops australis 7
Dromornis stirtoni 25
 droughts, and extinctions 39–42
 dry rainforest Plate 15
 adaptation to large browsers 119
 dune building 78
 dunnarts 9, 99
 dust records 78, 94
 dwarfing
 impact of hunting on 111–12
 Pleistocene marsupials 34–5
 dwarfing test 111–12
 E55–6
 charcoal concentrations 92
 pollen core sediment analysis 86, 122
 Early Miocene faunas 8
 eastern grey kangaroo 34, 163
 eastern hare-wallaby 172, 177, Plate 23
 eastern quoll 172, 179, 190, 209, 215
 echidnas 5, 28, 33, 69–70, 79
Echymipera kaluba 86
 ecological aftermath of megafauna extinctions 115–28
 megafauna dispersal syndrome 119–21
 plant defences against browsers 16–19
 plant responses to extinctions 121–9
 ecological implications of mammal decline 181–6
 foraging for seeds and soil turnover 181, 184–6
 spreading of spores and seeds 181, 182–4
 ectotherms 231
 eel trapping 139, 141
 Egg Lagoon, King Island 86, 91
 El Niño events
 and droughts 41
 ice ages 80–1
 El Niño–Southern Oscillation (ENSO) 80–1, 94, 95
 and charcoal peaks 93–4
 emu 25, 26, 63, 120, 122
 giant see *Genyornis newtoni*
 emu apples 120
 endotherms 231
 environmental change
 and Aboriginal history 132–47
 and extinctions 36–7
 Eocene climate 5, 8–9
 Eocene rainforests 5, 9
 eucalypts 83, 84, 85, 86, 95
Eucalyptus tetradonta woodland 143
 European settlement
 impact on mammal populations 162–5
 mammal extinctions caused by 3, 168–86
 extinct species, European Australia 169, 175–81
 bandicoots 178–9
 hare-wallabies 177
 native rodents 180–1
 rat-kangaroos 172, 175–6
 thylacine 153–6, 179
 wallabies 177–8
 extinction patterns (European Australia) 168
 body size and geography 168–70
 four waves of extinction since 1820s 171–5
 extinctions
 hyperpredatory 212–16
 number of 2–3
 selectivity 33–4, 35, 53, 54, 98–105
 test framework 53–4
 timing of 3, 53, 96–7
 feathertail possum 29
 feral cats
 and extinctions 205, 216, 228, 229, 234
 and mammal decline 203–6, 207, 211, 222
 and rabbit population decline 226
 as source of disease 189
 distribution in Australia 204, 205
 historical spread 198
 neutralising predation by 223, 224
 origins 204
 predation on mala 203–4
 predation on rabbits 214
 suppressed by coyotes 220
 suppressed by dingoes 224

- feral dogs 215
 feral goats 222, 225
 feral pigs 225
 ferns 83, 84
 Finlayson, Hedley Herbert 1–2
 fire
 and climate instability 142
 and mammal decline 192–3
 and vegetation change, following
 megafauna extinctions 124–6, 191,
 192
 human evidence of use 92–3, 143–4
 impact on pre-peopled Australian
 environment 90–2
 impact on small mammals 221
 in Australia 142–6
 Pleistocene history of 90
 vegetation and people 90–4, 95
 see also Aboriginal burning; charcoal
 fire hypothesis
 and extinctions 43–4, 51
 and vegetation change, Flannery model
 124–6, 191, 192
 criticisms 192–3
 fire-tolerant vegetation 90
 firestick farming 142, 144
 fixing dates on the past 55–7
 Flannery, Tim
 blitzkrieg version of overkill 45, 46
 fire regimes and vegetation change
 following megafauna extinctions
 124–6, 191, 192
 overkill views criticised 46–9
Flindersia dissosperma 117
Flindersia maculosa 117
 flying foxes 14
 foraging by rat-kangaroos, bandicoots
 and bilbies, ecological implications
 184–5
 forests
 Eocene 5, 9
 interglacial 84
 see also rainforests
 fossil abundance, and true extinction date
 72–4
 fossil marsupials 6–7
 fossil placentals 7
 foxes 189, 191, 197–203, 207, 223, 234
 1080 baiting 202, 224
 and mammal declines 199–203, 211
 and mammal extinctions 202–3, 206,
 216, 228, 229–30
 and rabbit population decline 226
 as predators on sheep 226
 bounty payments 199
 distribution 200
 historical spread 198–9
 introduction to Australia 197–8, 199
 neutralising predation by 202, 224
 predation on reintroduced macropods
 201
 rabbits and mammals, and hyperpreda-
 tory extinction 212–16
 sensitivity to natural ‘1080’ poison 201
 suppressed by dingoes 217–19, 225
 surplus killing 202
 Fromms Landing 149
 fruit bats 14
 fruit eating
 by megafauna 119–21, 128
 by rat-kangaroos and rodents 183–4
 fungal spores, dispersal by mammals
 182–3
Gastrolobium 184, 201
 GC17 (Pilbara Coast)
 charcoal concentrations 92, 125
 pollen core sediment analysis 85, 122
Genyornis newtoni 25–6, 26, 35, 37, 71, 120
 burning effects on 43–4
 dating 63
 geographic distribution, and extinctions
 170, 171
 giant emu see *Genyornis newtoni*
 giant horned turtle 27
 giant koala 16
 giant musky rat-kangaroo 27–8, Plate 8
 giant snake 27
 Gilbert’s potoroo 172
 glacial climate 11
 glacial cycles
 and colonisation of Australia 57
 impact on Australian environment
 41–2
 Pleistocene 11, 12, 76–81
 temperature and carbon dioxide levels
 76–7
 see also last glacial cycle
 glaciers 79
 gliding possums 4, 29, 98
 glossary 264–6
 goats 222, 225
 golden-backed tree rat Plate 3
 golden bandicoot 179, 193, 203
 Gould’s mouse 180, 181, Plate 33
 grass seeds, use of 138
 grasses 83, 84, 86, 122, 123
 great drought 39–42
 great hopping-mouse 171, 180
 Greater Australia
 archaeological sites for human
 occupation 59t
 map of 11, 12, 58
 greater bilby 173, Plate 37
 greater glider 28
 Gregory Lakes 87, 88
 ground-dwelling mammals
 decline of 221, 222
 population increase by restoring vege-
 tation 226–7, 234
 ground-nesting birds 35
Gymnastoma 5
 habitat clearing
 and mammal decline/extinction 193
 impact on toolache wallaby 193–4
 habitat revegetation 226–7
Hakea 117
 hare-wallabies 171, 172, 175
 height dimorphism 117–18, Plate 14
 herbivore evolution
 impact of glacial climates on 100
 Pliocene/Pleistocene 9–11
 herbivorous birds 25–6
 herbivorous mammals
 biomass distribution in relation to
 body size 115
 impacts on vegetation 116
 late Pleistocene 16–26
 non-extinct and extinct species
 115–16
 herbivory, obsolete defences against 116–19
 high-quality plant food, requirement for 99
 Holocene
 burning and human population
 growth 144–5
 charcoal concentrations 144
 introduction of dingo 148–53
 mammal declines 162–5
 mammal extinctions 3, 34
 population growth 136–7
 thylacine dates 154–7
 tool development 137–8, 141–2
 honey possum 4, 29
 hopping-mice 171, 180, 181
 house mouse, as source of disease 189
Hulitherium thomasettii 20
 human arrival in Australia 57–61
 and resultant extinctions 228, 229
 charcoal concentration evidence 92–3
 dates for earliest occupation 58–61, 59t
 fixing dates for, methodologies 55–6
 hunting overkill leading to megafauna
 extinctions 37, 44–9, 50, 51, 97,
 102–5
 origins of ancestors 57
 see also Aboriginal burning; Aboriginal
 hunting; Aboriginal people
 human dispersal in Australia 61–2
 human occupation sites 61–2
 fixing dates for earliest 58–61, 59t
 overlap of artefacts and megafauna
 remains 68, 71–2
 hunter-gatherer economy 44, 45
 hunting
 impact on dwarfing 111–12
 of thylacines, Tasmania 179, 194–7
 see also Aboriginal hunting; overhunting
 hunting overkill and extinctions 37, 44–6,
 50, 51, 97
 criticisms 46–9
 power of late Pleistocene hunters
 106–14
 species most at risk from 102–5

- Hydromys* 13
hyperdisease 49–50
hyperpredatory extinction 212–16
Hypsiprymnodon moschatus 28
Hypsiprymnodontidae 28
- ice age climates
carbon dioxide 76
climate variability 80–1
temperature 76–7
water 78–80
- Idiospermum australiense* 121
insectivorous species 99
intensification of resource use, Aboriginal people 140–1
interglacials, vegetation change 84
introduced herbivores
versus introduced predators 210–12
see also rabbits; sheep
introduced predators 197–206
feral cats 189, 198, 203–6, 211, 214, 216, 220, 222, 229
red fox 189, 191, 197–203, 211, 212–19, 228, 229–30
versus introduced herbivores 209–11
ironwood 117
Isodon auratus 179, 203
Isodon obesulus 190
- Jinmium Rock-shelter 58
- kangaroo hunting, fire use for 145–6
kangaroos 9, 115
as seed dispersers 120–1
controlled by dingoes 219, 225
extinctions 172
largest 25
Pleistocene dwarfing 34–5
Pleistocene extinctions 16, 21–5, 28
population numbers, mid-19th century 161–2
reasons for population increase 164–5
slow reproductive rates 233
see also sthenurine kangaroos; tree kangaroos
- Keilor 68
Kelangurr Cave 68
kill sites 47, 48
Kimberley rock painting 156
Kiowa Rock-shelter 154
koalas 29, 34, 74, 99, 115, 165
disease epidemics 188
population number 163–4, 191
Kokopellia juddi 6
Kollikodon ritchiei 4
Kolopsis watutense 20
Kulpi Mara 61, 133, 192
- Lagorchestes* 177
Lagorchestes hirsutus Plate 34
Lagorchestes leporides Plate 23
- Lake Callabonna fossil site 17, 30, 40
Lake Coomboo, Fraser Island 83–4, 91
Lake Eyre 25, 78–9, 85, 94, 122–3
Lake George 79, 84, 90, 95, 122
Lake Menindee 67, 155
Lake Mungo 58, 60, 61, 72, 79–80, 155
Lake Selina 90
Lake Tandou 68
Lake Wangoom 71, 84, 86, 93, 122
Lancefield Swamp, Victoria 68
late survival of megafauna 66–7
large-bodied herbivores
as browsers 101
resilience to glacial climates 100
Lasiorhinus angustidens 34
Lasiorhinus latifrons 42
last glacial cycle
and charcoal levels 94
climate variability 80–1
megafauna survival of 72–5
putting it in perspective 94–5
temperature and carbon dioxide levels 76–7, 123
vegetation and climate change 81–9, 122–4
water availability 78–80
Last Glacial Maximum (LGM) 77, 79
climate variability 80, 95
environmental change and Aboriginal people 132–4
sea level rise at end of 134–5
vegetation change 84, 85, 86, 87–9, 94, 122, 123, 125, 128, 134
late Holocene *see* Holocene
late Miocene fauna 9
late Pleistocene *see* Pleistocene
late survival past 46 kyr
evidence for 64–8, 67t
evidence from rock painting and other cultural records 69–70
reliability of dates 68–9
Lava Cave 154, 157
Lembudu Cave 68
leopardwood 117
Leporilus apicalis Plate 31
Leptospermum 144
lesser bilby 178, 203, Plate 28
lesser stick-nest rat Plate 31
Lime Springs 68
Lombok Ridge marine sediments 84, 86, 90, 92
long-beaked echidna 28, 69, 70, Plate 9
long-footed potoroo 176
long-tailed hopping mouse 181, Plate 32
long-tailed planigale Plate 2
Lourandos' 'intensification' of resource use 140–1
luminescence dating 56
Lynch's Crater, Atherton Tablelands 83, 90, 92, 95, 125, 128
- Macquarie Island parakeet 213–14
macropod diversity 9
Macropodidae 9, 16, 22–5
Macropodinae 22, 105
extinct 25
Macropterothanes keckwickii 118
Macropus 25
Macropus dorsalis 138
Macropus eugentii 164
Macropus giganteus 34, 66, 111
Macropus greyi Plate 25
Macropus irma 164, 177
Macropus parryi 177
Macropus robustus 163
Macropus rufus 163
Macropus titan 34, 37, 66, 111
Macrotis lagotis 164, 173, Plate 37
Macrotis leucura Plate 28
Madura Cave, Nullarbor Plain 149
Main Cave 68
mala 172, 203–4, Plate 34
Malakunanja 60, 61, 72
mammal carnivores *see* carnivorous mammals
mammal decline
and ecosystem decay 181–6
and vegetation change 221
causes
disease epidemics 188–91
fire hypothesis 191–3
introduced predators 197–206, 212–20, 222
killing and habitat clearing 193–7
rabbits 207–9, 210, 211
sheep plague 210, 211–12
complete model and its implications 222–7
four-stage scheme of, European Australia 171–5
late Holocene 162–5
mammal extinctions in European Australia 3, 168–86
causes 187–206
fire hypothesis 191–3
hyperpredation 212–16
introduced predators 197–206
killing and habitat clearing 193–8
plague and pestilence 188–91
characteristics 174–5
extinct on the mainland, persists on islands 169t
extinct species 169t, 175–81
extinction pattern 168–75
totally extinct 169t
mammal extinctions, late Pleistocene 99
mammal fauna
coexistence with exotic predators 215
origins and evolution 3–14
slow reproductive rates 232–3
susceptibility to placental predators 230–1

- vulnerability to the Australian environment 231–2
- mammal fauna extinctions
New Guinea 16
South America 3
- mammal herbivores
distribution of biomass in relation to
body size 115
extinct 115
impacts on vegetation 116
late Pleistocene 16–26
non-extinct species 115–16
- mammal populations, cessation of hunting on 162–5
- mammal predators 26–7, 32, 45, 230–1
see also devils; dingoes; feral cats; foxes; thylacines
- mammals
dispersal of spores and seeds 182–4
high energy demands as endotherms 231
refuges from predation 200–1, 211
- Mammoth Cave, WA 71
- Mandu Mandu Rock-shelter, WA 62, 155
- mangroves 84, 86
- Maokopia ronaldii* 20
- Mareeba rock-wallaby Plate 19
- marsupial decline, mid- to late-Miocene 9
- marsupial diversity 8, 9, 10
- marsupial evolution 4, 6–12
- marsupial extinctions 3
- marsupial lion 26, 32, 70, 233, Plate 7
- marsupial mole 4
- marsupial moles 29
- marsupial tapir 16, 20, Plate 5
- marsupial ‘wolves’ 11
- marsupials, reproductive rates 232
- megabrowsers 115–16
plant defences against 116–19
- megafauna bones
poor preservation of 72
use by Aboriginal people 71
- megafauna dispersal syndrome 119–21
- megafauna extinctions
and the last glacial cycle 72–5
causes 36–54
complex hypothesis 51–3
early ideas 1860–1968 36–8
fire and the remaking of Australia 43–4, 51
Flannery’s overkill views criticised 46–9
great drought 39–42
hyperdisease 49–50
modern debate 38–50
overhunting 44–6
overview 50–1
ecological aftermath 115–29
fixing dates for 62–75
methodologies 55–7
plant responses to 121–9
- Pleistocene 3, 16, 28–9, 37, 39–42, 53, 72–4
- South America 3
- Tasmania 97
- testing hypotheses on 53, 96–114
power of Pleistocene hunters 106–14
selectivity extinction 98–105, 112–13
timing on extinctions 96–7
- ‘megafauna fruit’ 120–1, Plate 16
- megafauna remains
age distribution of dated 64
dating 62–3
criticisms 63–4
youngest articulated remains 63
- evidence for late survival 64–72, 67t
Cuddie Springs site 64–6
depiction as ‘dreamtime animals’ 69–71
Lancefield Swamp site in Victoria 66–7
overlap with human occupation sites 68, 71–2
reliability of dates 69
- megafauna survival of last glacial period 72–4
- megafaunal naivety 46–7, 49, 107–8
- megaherbivores 16–26
resilience to glacial climates 100
- Megalanina* 32, 33
- Megalanina prisca* 27
- Megalibgwilia ramsayi* 28
- Meiolania* 27
- Meiolania oweni* 27
- Meiolania platyceps* 27
- Melaleuca* 84, 172
- Melomys* 13
- Mesembriomys macrurus* Plate 3
- mesopredator release 220–1
- Metasthenomys* 22
- metatherians 6
- microbiotheriids 7
- Microseris scapiegera* 141
- mid-Oligocene faunas 8
- mihirungs 70–1, 120
- model of interactions that led to decline and extinction of Australian mammals 222–7
other pressures on native mammals 223–4
prey species
body size 222–3
distribution and habitat 223
- moist tropics, pollen core sample analysis 83–4
- Monajee Cave 154
- monitors 27
- monotreme fossils 4
- monotremes 5, 8
evolution 3
reproductive rates 232
- Mootwingee rock art site 71
- Morton’s hypothesis on collapses of
critical-weight-range mammals 232
- mosaic-tailed rat 13
- movement styles, and risk of extinction 105
- Mt Etna caves 3
- Murinae 12–13
- murnong 141
- Murra-el-elevyn Cave, Nullarbor Plain 154
- Murray Cave 154
- musky rat-kangaroos 27–8
- mycorrhizal fungi 182–3
- Myrmecobius fasciatus* 173
- Myrtaceae 85
- Naracoorte Caves 74
- narrow-leafed bumble 117
- nature reserves, exclusion of predators from 224
- Nauwalabila 60, 61, 72
- NcEachern Cave 154
- New England possums 164
- New Guinea
as centre of diversity for tree kangaroos and cuscuses 12
climate change effects 11, 12
rodents entry from 13
thylacine remains 155
vegetation changes and extinctions 41
- New Guinea mammal extinctions 16, 33
- Ngarrabullgan 58
- Ngurini Rock-shelter 149
- nineteenth century ideas on extinctions 36–7
- ningauis 99
- Nombe Rock-shelter 68, 155
- non-flying mammals
energy needs 231–2
unsuitability to Australian environment 232
- North America, overhunting 44–5
- North American faunas 7
- northern bettong Plate 35
- northern hairy-nosed wombat 170
- northern quoll 222
- Nothofagus* 5, 7, 84, 86
- Nothofagus cunninghamii* 86
- Notomys longicaudatus* Plate 32
- Nullarbor dwarf bettong 176
- numbats 201, 202
decline in range 173
- Occam’s Razor 52
- occupation
fixing dates for earliest 58–61, 59t
low productivity habitats 140
- occupation sites
Australia 61–2
impact of Last Glacial Maximum on 133–4

- ocean circulation, changes in 8–9
 ODP 820 (wet tropical north-east)
 charcoal concentrations 92, 93, 125
 pollen core sediment analysis 83, 95
 omnivorous mammals 27–9
Onychogalea faenata Plate 38
Onychogalea lunata Plate 24
 oolacunta 1–2, 2, 216
 optically stimulated luminescence (OSL)
 56
Ornithorhynchus 5
Oryctolagus cuniculus 207
 overhunting 37, 44–6, 97
 blitzkrieg hypothesis 44–5, 50
 criticisms of Flannery's views
 lack of archaeological evidence
 47–9
 lessons from predator prey theory 49
 megafaunal naivety 46–7, 49
 models 106–8
 power of late Pleistocene hunters
 106–14
 species most at risk from 102–5
 population density effects 104–5
 slow-moving species 105
 slow-reproducing species 102–4
 species living in open habitats or
 on the ground 102
 Owen, Sir Richard, views on extinction
 36–7
Owenia 120, 128
- pademelons 34, 138, 164, 190
 Padyapadiy, East Alligator River 157
Palorchestes 20, 70
Palorchestes azeal Plate 5
 palorchestids 16, 20, 29
 Parmepar Meethaner, Tasmania 62
Perameles bougainville 179
Perameles eremiana Plate 27
Petauroides 28
Petauroides ayamaruensis 34
Petauroides volans 34
Petrogale lateralis 201
Petrogale mareeba Plate 19
Phalanger 12
Phascolarctos stirtoni 74
Phascolomus gigas 21–2, 22, Plate 6
 pig-footed bandicoot 178–9, 203, 216,
 Plate 26
 pigs 225
Pittosporum lancifolium 118
Pittosporum spinescens 118
 placental mammal fossils 4
 placental mammals, evolution 3–4, 6, 7
 placental predators, mammal fauna suscep-
 tibility to 230–1
Planigale ingrami Plate 2
 planigales 9, 99
 plant declines following megafauna
 extinctions 126–9
- plants
 chemical defences 116, 118
 defences against herbivores 116–19,
 127–8
 divaricate growth 118
 height dimorphism 117–18, Plate 14
 responses to megafauna extinction
 121–9
 fire 124–6
 plant declines and extinctions
 126–9
 vegetation structure 122–4
 seed dispersal by mammals 119–21
 spininess 117
 in young plants, but absent in
 mature 118
 structural defences 116–18
 see also vegetation
 platypus 5
 Pleistocene environment 76–95
 fire in Australia 90–1
 ice age climates 76–81
 large predators in 233–4
 people, fire and vegetation 90–4
 vegetation and climate change 81–9
 Pleistocene fossil sites
 Darling Downs region 73
 northern Australia 30
 Pleistocene glacial periods 3, 11, 12, 72–5,
 76–81
 Pleistocene hunters, power of 106–14
 Pleistocene mammal extinctions
 problem of lack of complete skeletons
 30
 species list, Australia and New Guinea
 18–20
 Pleistocene marsupials
 mass range 30
 size-selectivity of extinctions 33–5
 Pleistocene megafauna 16–35
 problems and controversies 30–3
 Pleistocene megafauna extinctions 3, 16,
 28–9
 and great drought 39–42
 and Signor-Lipps Effect 72–4
 causes 37, 53
 Pliocene
 evolution of herbivores 9–11
 vegetation 9
 Poaceae 83
 Podocarpaceae 5
Podocarpus 83
 poison pea 184, 201
 pollen core sample analysis
 arid zone 84–5
 Bassian Plain 86–7
 Carpentarian Plain 85–6
 moist tropics 83–4
 southeastern Australia 84
 population density, and risk of extinction
 from overhunting 104–5
- population growth, Aboriginal people,
 Holocene 136–7, 142
 possums 29, 164, 165
 disease epidemics 188–9
 Potoroidae 27
 potoroos 172, 176, 182
Potorous gilbertii 172
Potorous longipes 176
Potorous platyops Plate 22
 power of late Pleistocene hunters 106–14
 dwarfing test 111–12
 overhunting models 106–10
 did people hunt megafauna to have
 a significant effect? 108, 110–11
 Diprotodon optatum demographic
 model 109–10, 111
 lack of archaeological evidence 113
 prey naivety 46–7, 49, 107–8
 selective extinction of large vertebrates
 112–13
 predation on critical-weight-range
 mammals 204, 205, 215–16, 220, 221
 complete model 222–7
 predator–prey interactions 212–16, 228–9
 predator–prey theory 49
 predators
 biological control of 224–5, 226
 introduced 197–206, 209–11, 212–19,
 220, 222, 228, 229–30
 mammal 26–7, 32, 45
 neutralisation of 223–4
 reducing impact of through habitat
 revegetation 226–7, 234
 sheep, cattle and dingoes 225–6
 thylacines as 157, 179
 prey naivety 46–7, 49, 107–8
 prey species
 body size 222–3
 distribution and habitat 223
Procoptodon 25, 105
Procoptodon brownmoreum 71
Procoptodon goliath 25, 43
Propleopus oscillans 28
Propleopus wellingtonensis 28
Protomndon 25
Protomndon anak 24
Protomndon hopei 25
Pseudochirus 28
Pseudochirus 28
Pseudomys 181, 193
Pseudomys gouldii Plate 33
Pseudomys patrius Plate 4
 Puritjarra 61, 133, 192
 pygmy possum 29, 115
- quandong 184
 Queensland pebble-mound mouse Plate 4
Quinkana fortirostrum 27, 32
 quokkas 164, 193, 200
 quolls 172, 173, 188, 200, 222, 223

- rabbit haemorrhagic disease 226
 rabbit plagues 208–9, 211
 rabbits 176, 189, 191, 207–9
 contribution to mammal declines 208–9, 210, 211
 feeding habits 208
 foxes and mammals, and hyperpredatory extinction 212–16
 historical spread 198, 207
 introduction to Australia 207
 population decline, impact on cats and foxes 226
 radiocarbon dating 55–6
 rainfall decline, and large mammal extinctions 39–40
 rainfall increase, at end of LGM 135
 rainfall pattern, under glacial conditions 79–80, 89
 rainforest faunas 12, 28
 rainforests 9
 and marsupial arrivals 8
 Cretaceous 5
 pollen analysis 83–4
 spread at end of LGM 135
 vegetation change under LGM 89
 rat-kangaroos 164, 211
 bounty payments 199
 distribution of fruit and seeds 183
 distribution of fungal spores 182–3
 extinct species, European Australia 172, 175–6
 foraging behaviour, ecological implications 184–5
 foxes impact on 199–200
 Holocene 34
 Pleistocene 27, 33
Rattus 13
 red fox 189, 191, 197–203
 red kangaroos 163
 refuge-seeking behaviour 200–1, 211
 refuges, improving by revegetation 226–7
 reintroduced mammal species
 exclusion of predators from 224
 improving survival through habitat revegetation 226–7
 predation by feral cats 203–4
 predation by foxes 201
 reintroduction of Tasmanian devils into southeastern Australia 235
 reproductive rates
 and extinction patterns 102–4
 Australian mammals 232–3
 reptiles, Pleistocene 27, 32, 37
 body mass 32
 revegetation, to improve refuges 226–7
 ringtail possum 29
 rising sea levels, at end of LGM 135–6
 Riwi 71
 Roberts *et al.*s dating of megafauna fossils 62–3
 criticisms of 62–3
 rock paintings
 ‘clothes peg figure’ style 156, 161
 depiction of conflict 135
 depiction of devils 157
 depiction of dingoes 157
 depiction of extinct megafauna 69–70
 depiction of hunting of devils 161
 depiction of hunting of thylacines 160
 depiction of long-beaked echidna Plate 9
 depiction of spear-throwers 161
 depiction of thylacines 155, 156, 157, Plate 17
 ‘dynamic figure’ style 160
 ‘large naturalistic animal’ style 155
 style differentiation by society 139
 ‘X-ray’ art style 155
 rock-piles, as mammal shelter from foxes 200–1
 rock-rats 201
 rock shelters
 growth in number of 136
 see also specific shelters
 rock-wallabies 201, 223
 rodents, native
 distribution of fruit and seeds 183–4
 distribution of fungal spores 182, 183
 extinct species 180–1
 extinction 1840s to 1930s 171–2
 foxes impact on 200
 origins and evolution 12–13, 29
 reproductive rates 215
 toxoplasmosis in 189
 see also conilurine rodents
 rufous bettong 164, 176, 200
 rufous hare-wallaby 172, 203–4, Plate 34
 sandalwood 184
Santalum acuminatum 184
Santalum spicatum 184
Sarcophilus lanianus 74
 scaly-tailed possum Plate 18
 scavengers 32–3, 157, 159
 sclerophyll forests 83, 84, 89
 scrub leopardwood 117
 sea level changes
 and colonisation of Australia 57
 at end of Last Glacial Maximum 134–5, 137
 Pleistocene 11
 sedges 83, 84, 86
 seed dispersal
 by megafauna 119–21
 by rat-kangaroos and rodents 183–4
 impact of loss of 128
 seed resources, utilisation 140
 selectivity extinction 33–4, 35, 53, 54, 98–105
 climate and vegetation change 98–101
 overkill 102–5
 through human impact 112–13
 Seton Rock-shelter 68
Setonix brachyurus 164, 193
 Seymour Island faunas 6, 7
 Shark Bay mouse 181
 sheep 209–10
 distribution 198
 impact on mammal extinction/decline 210, 211–12
 overgrazing and vegetation destruction 209, 212
 population explosion 209, 210
 predated on by dingoes 225–6
 predated on by foxes 226
 rabbits and foxes 212
 short-faced kangaroos 16, 22–5
 shrublands 122, 126
 Signor-Lipps Effect 72, 73–4
 implications for late Pleistocene palaeontology and archaeology 74
Simosthenurus 22, 23, 105
Simosthenurus maddocki 22, 120
Simosthenurus pales 74
Sinodelphys szalayi 6
 size-selectivity of Pleistocene extinctions 33–5
 slow reproductive rates
 late Pleistocene species 102–5
 mammal fauna 232–3
 slow-moving species, at risk of extinction from overhunting 105
 social change, Aboriginal people 139–41
Solanum 117, 118
Solanum macoorai 118
Solanum viride 118
 South American extinctions 3
 South American faunas 6, 7
 southeastern Australia, pollen core sample analysis 84
 southern brown bandicoot 190
 spear-throwers 161
 species decline, and distribution range 173–4
 species disappearance, and timing of its decline to rarity 173, 174
 species living in open habitats or on the ground at risk of overkill 102, 103
 species vulnerability to vegetation and climate change 98–101
 dependence on dense and diverse ground vegetation 98–9
 dependence on dense forest 98
 insectivores 99
 requirement for high-quality plant food 99
Spilocausus 12
 spinifex-dominated landscape, Kimberley, WA Plate 10
 spininess
 as defence against browsers 116–17, 118
 loss of, after removal of browsers 128

- spiny foliage of juvenile arid-zone acacia Plate 13
- spotted-tail quoll 188
- Steropodon galmani* 4, 5
- sthenurine kangaroos 16, 22–5, 70
diet 22, 25
impact of climate on 41, 101
morphology and distribution 22
use by Aboriginal people 71
- Sthenurus* 22, 23, 37
- Sthenurus stirlingi* 22
- Sthenurus tindalei* 22
- stick-nest rats 180
- Strigocuscus* 12
- striped possum 34
- survival into the last glacial cycle 72–4
- surplus killing, by foxes 202
- Tachyglossus aculeatus* 28
- tammar wallaby 164, 200, 201
- Tanami Desert
mala reintroductions 203–4
mammal decline 193
- Tasmania
destruction of thylacines 179, 194–7
kangaroo abundance 163
megafauna extinctions 97
occupation sites 62, 134
pollen records 86–7
- Tasmanian Aborigines
dog ownership 150
impact on kangaroo populations 163
tool use 141–2
use of dogs for hunting 151
- Tasmanian bettong 172, 176, 202, 221
- Tasmanian devil 4, 27, 34, 190
coexistence with native mammals 235
disease impact on 223
reintroduction into southeastern Australia 235
- Tasmanian pademelon 190
- Tasmanian tiger *see* thylacine
- Temnophas trusleri* 4
- temperature cycles, ice ages 76–7, 80, 89, 94
- terrestrial herbivores 9–11, 14
- test framework for extinction 53–4
power to account for the magnitude of the extinction event 53, 106–14
selectivity of extinction 53, 98–105
timing of extinctions 53, 96–7
- thermoluminescence 56
- thylacine 27, 29, 32, 70, 169, 171, 194, 233, Plate 29
as specialist predator 157, 179
bounty scheme, Tasmania 179, 194–7
depiction in rock painting 155, 156, 157, Plate 17
depiction of hunting in rock painting 160, 161
- disappearance before dingo arrival 156–7
- disease in 190, 196
- Holocene dates 154–7
- human impact on 159–61
- interactions with devils 162
- locations, mainland Australia 154–6
- mainland extinction of 153–6
- natural abundance 160
- outcompeted by dingoes 153–4, 157–9
criticisms 158–9
- Thylacine Hole, Nullarbor Plain 149, 154
- Thylacinidae 11
- Thylacinus cynocephalus* 194, Plate 29
- Thylacoleo carnifex* 26–7, 32, 70, 233, Plate 7
- Thylacoleonidae 11, 26–7, 29
- Thylogale* 138
- Thylogale brunii* 34
- Thylogale chistenseni* 34
- Thylogale thetis* 164
- tigers *see* thylacine
- timing of extinctions 3, 53, 96–7
- Tingamurra fauna 6–7, 13
- Tingamurra porterorum* 7
- tool development
by Aboriginal people 160–1
Holocene 137–8, 141–2
- toolache wallaby 169, 171, 177–8, Plate 25
attempt at preservation 178
habitat clearing impact on 193–4
- Toxoplasma gondii* 189
- toxoplasmosis 189, 190
- tree kangaroos 12, 34, 99, 163, 165
population number 164
- Trichosurus vulpecula* 164
- tropical vegetation, pollen analysis 83–5
- uranium/thorium (U/Th) dating 56–7
- Uromys* 13
- Van Diemen's Land Company 179, 194
Woolnorth Station, numbers of thylacines killed 194–6
- vegetation
and climate change 81–9
and species vulnerability 98–101
- C₃/C₄ plant composition changes 122–4
- fire and people 90–4
- vegetation change
and extinctions 37, 41, 97
and small mammal decline 221
carbon isotope signatures of 87–8
- Eocene to Pleistocene 10
- interpretation of LGM data 88–9
- last glacial cycle perspective 94–5
through pollen analysis 82–7
under low carbon dioxide levels 81–2
- vegetation structure, changes following megafauna extinction 122–4
- Vulpes vulpes* 197
- waddywood 117
- wallabies 9, 164
extinct species 177–8, 200
extinctions 169, 171, 172
- wallaroos 163
- wandering albatross, population decline 114
- Warendja wakefieldi* 20–1
- Warren Cave, Tasmania 62
- water availability, ice ages 78–80
- water rats 13
- Western Australia, occupation sites 61–2
- western barred bandicoot 179
- western brush wallaby 177
- western grey kangaroo 163
- western quoll, decline in range 173
- Western Shield program, WA, 1080
baiting 202, 224
- wetlands 135
- whiptail wallaby 177
- white-footed tree rat 180, Plate 30
- 'wide-awake' 1–2, 216
- Widgingarri Rock-shelter 154
- wild dogs *see* dingoes
- wild lime 117
- wild orange 117, 120, Plate 16
- wild pomegranate 120
- Wilkinson's views on extinctions 37
- Willandra Lakes 42
- Wombah Midden, eastern NSW 149
- wombat-like creatures 16, 17–20
see also diprotodonts
- wombats 4, 11, 16, 20–2, 29, 37, 105, 115
diet composition change 123
disappearance from Willandra Lakes region 42
Pleistocene dwarfing 34
threatened with extinction 170
- Wonambi naracoortensis* 27, 32
- woylie 164, 176, 201, 202, 203, 221
fruit eating 184
seed-caching and burial 184
- Wyulda squamicaudata* Plate 18
- Xeromys* 13
- Yamuti 70
- Zaglossus* sp. 28, 69, Plate 9
- Zaglossus hacketti* 28
- Zygomaturus* 71
- Zygomaturus trilobus* 17–20, 116