

## Index

Page numbers in *italics* refer to figures and boxes

- Abies* spp. *see* fir
- acacia 24, 26, 33, 76, 93, 124, 144
- Acer* spp. *see* box elder; maple; sycamore
- acorns 145, 216, 220, 236
- Adansonia digitata* *see* baobab
- Aesculus* spp. *see* buckeye; horse chestnut
- Agave* spp. *see* century plant
- age of trees 178–9, 180, 181–5, 256–9, 265–6
- Ailanthus altissima* *see* tree-of-heaven
- Albizia falcata* 157
- alder
- bark 61
  - flowers 114
  - fruit 114, 143
  - growth patterns 171, 172, 196
  - leaves 17
  - roots 93, 94, 96, 103, 107
  - salt damage 261–2
  - seeds 147, 182
  - soil 166
  - wood 44, 49, 55
- alder buckthorn 112, 114
- almond 103, 143
- Alnus* spp. *see* alder
- aloe 3
- Amelanchier* spp. *see* mespil
- angelica tree 9, 10, 11
- angiosperms *see* hardwoods
- animals
- damage 231, 238, 239
  - pollination 121, 124, 125, 126, 133–4
  - seed dispersal 151–3
- apical dominance *see under* growth
- apical meristem *see* meristem
- apple
- flood tolerance 105
  - flowers 116, 154
  - fruit 116, 147
  - fungus 262
  - growth patterns 171
  - leaves 9, 13, 15
  - masting 148
  - pollination 112, 136, 140
  - pollution 260
  - roots 90
- apricot 103
- Aralia* spp. *see* angelica; Hercules' club
- Araucaria* spp. 160 *see also* monkey puzzle
- tree; pine, New Caledonian
- Arbutus* spp. *see* madrone; strawberry tree
- ash
- bark 57, 58
  - damage by 79
  - as firewood 250
  - flowers 114, 139–40
  - frost damage 247, 260
  - fruit 114, 150
  - growth patterns 170
  - leaves 13, 33
  - longevity 257, 266
  - mycorrhizas 91
  - propagation 228
  - roots 75, 77, 107
  - seeds 183, 213, 214
  - soil preference 166
  - water movement 49
- aspen 22, 55, 138, 148, 160, 219, 225, 237
- Athrotaxis* spp. *see* cedar, Tasmanian
- Avicennia* spp. *see* mangrove

## **Trees: Their Natural History**

- avocado 6, 28, 90, 152, 172
- bacteria 64, 93–4, 232
- balsa 4, 124
- bamboo 1, 3, 59, 157
- banana 1, 3
- Banksia* spp. *see* bottle-brush trees
- banyan 108, 160, 192, 194
- baobab 6, 33, 124, 125, 160, 161
- barberry 115, 125, 232, 233
- bark
  - cambium 56, 58, 59, 60–1
  - food production 7, 25, 56–8
  - growth 38, 58, 59–63
  - lenticels 13, 58–9, 63
  - phloem 56–8, 59–60
  - in ring-porous trees 59–60
  - shedding 63–4, 175
  - structure 36, 37, 56–9
  - texture 61, 62, 63
  - thickness 63–4, 248
  - uses for 6, 57, 59
  - xylem 59–60
- beech
  - bark 60–1, 62, 63, 248
  - branch shed 200
  - damage by 80
  - environmental value 6
  - flowers 114, 178
  - frost damage 260
  - fruit 114, 145, 152
  - growth patterns 44, 170, 172, 201
  - hybrids 226, 228
  - leaves 9, 209, 210
  - light requirements 164
  - longevity 257
  - masting 147–8, 149
  - pollution 246, 260
  - roots 77
  - salt damage 262
  - seeds 184, 221, 224
  - Southern 91, 159, 224
  - temperature effects 177–8, 247, 248
  - uses for 6
- Berberis* spp. *see* barberry
- Bertholletia excelsa* *see* Brazil nut
- Betula* spp. *see* birch
- birch
  - bark 63
  - damage by 80
  - flowers 115, 131
  - frost damage 247, 260
  - fruit 115
  - growth patterns 196, 197, 252
  - leaves 9, 15
  - longevity 257
  - pollution 260
  - sap 45, 47
  - seeds 181, 218, 219, 223
  - soil preference 166
- birds
  - damage 231
  - pollination 122, 123–4, 133, 134, 138
  - seed dispersal 152–3, 220, 222, 223, 224
- black locust *see* false acacia
- blackberry 104, 105, 234
- blackcurrant 90
- blackthorn 115, 234, 263
- bog myrtle 115
- Boscia albitrunca* 76
- Boswellia carteri* *see* frankincense
- bottle-brush trees 123, 124, 248
- bottlebrush 107
- bougainvillea 123
- box 16, 104, 115, 262
- box elder 33
- bracts 32, 123, 130–1, 145, 150
- branches
  - apical dominance 26, 204–7
  - collaring 66, 67, 68, 69
  - grafting 192
  - growth 36–7, 66, 173, 191–2, 195–6, 200, 265–6
  - hydraulic segmentation 50–3
  - as levers 162, 192–3, 250
  - shedding 198–200, 207, 209

## Index

- see also* trunk
- Brazil nut 6, 143
- broom
  - flowers 115, 125, 126
  - fruit 115
  - hybrids 227
  - leaves 4, 25
  - seeds 153, 215
  - thorns 233, 234
- buckeye 171
- buckthorn 59, 116, 201
- buddleia 115
- buds
  - aborted 197
  - axillary 12, 13, 31, 195, 196, 197–8
  - epicormic 64–6, 187, 256, 265–6
  - flower 176, 201, 203, 205
  - growth 7, 168–72, 175, 196, 197–8
  - leaf 171, 201, 203, 205
  - mixed 170, 203, 205
  - scales 26, 168–9, 195–6, 197–8, 200
  - terminal 201, 203
- butcher's broom 3, 25, 26, 138, 139
- butternut 47
- Buxus* spp. *see* box
- cactus 7, 15, 18
- Calamites* *see* horsetail
- Calamus* *see* palm, rattan
- calluses 239–40, 241, 250–2
- Calocedrus* spp. *see* cedar, incense
- Calvaria major* 214
- cambium
  - cork 38, 58, 59, 60–3, 99
  - vascular 7, 37, 38, 45, 56, 174, 175, 244
- Camellia sinensis* *see* tea plant
- camphor-wood *see* laurel, camphor
- carbon dioxide 7, 9, 15, 16–18, 163, 165
- Carica papaya* *see* papaya
- Carnegiea gigantea* *see* cactus
- carob tree 6, 222
- Carpinus betulus* *see* hornbeam
- Carya* spp. *see* hickory; pecan
- cashew 145
- Cassia* spp. *see* Indian laburnum
- Castanea* spp. *see* chestnut, American; chestnut, sweet
- Casuarina* spp. *see* she-oak
- Catalpa* spp. 14, 34, 56
- catkins 124, 129–33, 138, 143
- cauliflorous species 138
- Ceanothus* spp. 96
- cedar
  - flowers 132
  - fungus 262, 263
  - growth patterns 171
  - incense 132, 141
  - Japanese red 23, 104, 198, 247
  - of Lebanon 159
  - needles 197
  - oils 243
  - pollination 133
  - pollution 246, 261
  - seeds 183
  - Tasmanian 23
  - taxonomy 2
  - true 132, 141, 146
  - western red 141, 164, 169, 171, 183, 246, 247, 260–1, 263
  - white 159, 169, 198, 237
- Cedrus* spp. *see* cedar, of Lebanon; deodar
- Ceiba pentandra* *see* kapok tree
- cellulose 7, 9, 41, 53
- century plant 40
- Ceratonia siliqua* *see* carob tree
- Ceratopetalum virchowii* 88
- Cercidiphyllum japonicum* *see* katsura tree
- Cercidium* spp. *see* palo-verde
- Cercis siliquastrum* *see* Judas tree
- Cercocarpus* 95
- Chaenomeles* spp. *see* quince, Japanese
- Chamaecyparis* spp. *see* cypress, false; cypress, Lawson; cypress, Nootka; cypress, sawara
- chemicals 83–4, 94, 211, 235–40, 243, 244

## **Trees:** Their Natural History

- cherry
  - bark 59, 61, 63
  - buds 196, 204
  - damage by 80
  - flood tolerance 104
  - flowers 116
  - fruit 116
  - growth patterns 171
  - gum 239–40
  - roots 103
  - suckers 224, 225
- chestnut
  - American 248
  - flood tolerance 105
  - horse *see* horse chestnut
  - sweet 121, 137, 145, 184, 217, 247, 260
- chimaeras 32, 227–8
- Chisocheton* 12
- chlorophyll 13, 25, 31–3
- Cinchona* spp. *see* quinine
- Cinnamomum* spp. *see* cinnamon; laurel, camphor
- cinnamon 6, 59, 237
- Cissus* spp. *see* liana
- citrus trees 28, 45, 60, 101, 172
- clematis 26
- climate 166–8, 174–8, 188–91, 222, 247
- cloning 225
- cloudberry 138
- clove 6
- clubmoss 3
- Clusia* spp. 18
- cocoa tree 6, 126–7, 138, 172
- coconut 146, 153, 213, 217, 220
- coconut, double 216, 217, 222
- Cocos nucifera* *see* coconut
- coffee 6
- Colletia* spp. 96
- Commiphora* spp. *see* myrrh
- Comptonia* 96
- cones 131–2, 137, 144, 146, 154, 155, 248
- conifers
  - buds 65, 169, 176, 197, 198
  - compression wood 68, 70
  - defined 4
  - evolution 3, 5
  - exceptions 4, 43, 65
  - growth rings 43–4, 45, 46
  - heartwood 242–3
  - layering 225
  - leaves 23, 24, 27
  - needles 4, 23, 55, 197, 209
  - reproduction 112, 131, 132–3, 141, 142, 154
  - resin 41, 42, 239, 242
  - root grafts 94, 98
  - root growth 101, 102
  - seeds 142, 146–7
  - serotinous 141, 248–50
  - shape 187, 188, 206, 208
  - structure 41, 42, 43–4, 45, 46
  - taxonomy 2
  - water movement 41, 48–9
- Copernicia cerifera* *see* palm, carnauba wax
- coppicing 66, 157
- Cordyline* spp. *see* palm, cabbage
- Coriaria* spp. 95
- Cornus* spp. *see* dogwood
- Corylus avellana* *see* hazel
- cotoneaster 104, 116
- Crataegus* spp. *see* hawthorn
- creosote bush 19, 20, 25, 198–9, 236, 258
- Cryptomeria* spp. *see* cedar, Japanese red
- × *Cupressocyparis leylandii* *see* cypress, Leyland
- Cupressus* spp. *see* cypress, Monterey; cypress, true
- currants 116
- cuttings 208, 226
- cycads
  - evolution 3, 5
  - leaves 4
  - longevity 141
  - reproduction 133, 138, 139, 141
  - roots 94
  - taxonomy 2

## Index

- cypress
  - bald *see* cypress, swamp
  - buds 169
  - damage by 80
  - false 141, 169
  - frost damage 260
  - fungus 262
  - Lawson 24, 198, 246, 261
  - leaves 9, 30
  - Leyland 78, 227
  - Monterey 227, 260
  - mycorrhizas 91
  - Nootka 227, 247
  - pollution 246, 261
  - sawara 226
  - swamp 4, 28, 91, 103, 107, 198, 200
  - taxonomy 2
  - true 198
- Cytisus* spp. *see* broom
- Dacrydium* spp. *see* pine, red
- damage to trees 8, 82–6, 211, 231–56, 259–65
- Daphne* spp. *see* laurel, spurge; mezereon
- date 142
- Davidia involucrata* *see* dove tree
- death of trees 259–66
- decay 241–2, 244–5
- deciduous trees 4, 15, 28–30, 55, 132
- defences
  - chemical 235–40, 243, 244
  - cold 246–9
  - fire protection 247–50
  - internal 241–2
  - physical 232–5
- dehydration 190, 198–9
- Dendrocalamus* spp. *see* bamboo
- dendrochronology 167–8
- Dendrocnide* spp. 234
- deodar 199, 207
- dicotyledons 2
- diffuse-porous trees 44–6, 48–9, 56, 175
- Diospyros* spp. *see* ebony; persimmon
- Discaria* spp. 96
- disease 98, 165, 259, 263–4
- dogwood 32, 200
- dormancy 170–4, 177, 213–15
- dove tree 32
- Dracaena* spp. *see* dragon tree
- dragon tree 2, 3, 40, 59, 258
- Drimys* spp. 43, 237
- Dryas* spp. 95
- durian 124
- Durio zibethinus* *see* durian
- Dutch elm disease 50, 98, 259, 263–4
- Eastern cottonwood 14, 261
- ebony 56
- Elaeagnus* spp. 96
- Elaeis guineensis* *see* palm, oil
- elder 80, 117
- elm
  - branch shed 199
  - buds 65, 202, 203
  - damage by 79
  - Dutch elm disease 50, 259, 263–4
  - flowers 117, 129, 130, 139, 141
  - frost damage 247, 260
  - fruit 117
  - fungus 264
  - growth patterns 44, 171, 172, 173, 175
  - heartwood 243, 244
  - leaves 9, 210
  - mycorrhizas 91
  - roots 97, 253
  - salt damage 261
  - seeds 182, 184, 218
  - suckers 225
- environmental benefits 7, 9, 16
- environmental damage 90, 165, 177–8, 245–56, 259
- Ephedra* 2, 43
- epiphytic plants 231–2
- Erica* spp. *see* heather
- eucalyptus
  - bark 63

## **Trees:** Their Natural History

- eucalyptus—*cont.*
  - buds 169
  - flowers 123, 176
  - fruit 144
  - height 157, 159
  - leaves 14, 16, 17, 27, 28
  - mycorrhizas 91
  - pollination 124
  - roots 98, 107
  - seeds 181, 216
- Eugenia caryophyllus* *see* clove
- Euonymus europaea* *see* spindle tree
- evergreens 4, 16, 28–30, 132, 173, 247
- evolution 3, 5
- Fabaceae 93–4, 95
- Fagus* spp. *see* beech
- false acacia
  - damage by 80
  - flood tolerance 105
  - fungus 262
  - leaves 16, 20, 26
  - light requirements 164
  - roots 94, 101
  - salt damage 262
  - sapwood 56
  - seeds 181
  - suckers 224–5
  - thorns 233, 234
- Ficus* spp. *see* fig
- fig 76, 81, 97, 106, 108–9, 127, 128, 147, 152
- fir
  - balsam 103, 216
  - bark 248
  - Douglas 41, 81, 92, 144, 158, 159, 160, 172, 184, 248
  - frost damage 260
  - grand 260
  - height 158, 159, 160
  - light requirements 164
  - longevity 257
  - mycorrhizas 92–3
- needles 28
- resin 239
- roots 76, 81, 103
- seeds 141, 183, 184, 216
- shape 191
- silver 76
- subalpine 191
- taxonomy 2
- true 133, 146, 239
- white 248
- fire 214, 216, 247–50
- firewood 250
- “flagged” trees 190–1
- flooding 103–7
- flowers
  - colour 112–13, 122, 123
  - conifers *see* cones
  - “cost” of production 140, 154
  - dichogamous 137
  - dioecious 135, 138–9, 140
  - exploding 125, 126
  - failure 154–5
  - hermaphrodite 137, 139
  - mass blooming 134–6
  - monoecious 129–31, 137–8, 139, 140
  - “rewards” 122, 125–7, 138
  - scent 112, 122, 134
  - sequential 134, 135, 150
  - sex change 139–40
  - shape affected 200–4
  - structure 113, 130, 131
  - timing 114–21, 176–7, 178–9
  - types 112, 114–22, 124, 129–33, 137–40
  - see also* catkins
- food production 9, 46, 47, 56–8 *see also* nutrition
- food storage 36, 54–5, 72, 98, 213, 222, 266
- “fossil” trees 5
- foxglove tree 9, 34, 147
- Frangula alnus* *see* alder buckthorn
- frankincense 239
- Fraxinus* spp. *see* ash
- frost 53–4, 246–7, 260

## Index

- fruit
  - aborted 154–5
  - attractiveness 143, 152
  - “cost” of production 139, 154
  - function 143–4, 146
  - multiple 147
  - parthenocarpic 141, 154
  - and seeds 142–7
  - timing 181–5
  - types 114–21, 142–3, 144–7, 150–1
- fungus 90–3, 165, 231, 232, 241–2, 259, 262–3, 264
- Ginkgo biloba* see maidenhair tree
- giraffes 124
- Gleditsia triacanthos* see honey-locust
- Gnetum* 2, 43, 133
- gooseberry 146
- gorse 4, 117, 153, 215, 218, 249
- grafting 192, 227–8
- grape 105
- grass trees 3, 40
- gravity 70, 162, 192–4, 250
- Grevillea* spp. 144
- Griselinia* spp. 109
- growing point *see* meristem
- growth
  - age effects 178–9, 180, 265–6
  - apical dominance 204–7, 225
  - callus 239–40, 241, 250–2
  - climate effects 165, 166–8, 174–8, 190
  - controlling 101–2, 163–6, 196–200, 204–7
  - in diffuse-porous trees 44–5, 172–3, 175
  - foxtail 172
  - height ratio 162, 163, 178, 179
  - hormones 102, 163, 175, 206
  - lammas 21, 172, 173
  - limits to 161–2
  - patterns 174–8
  - primary 7, 36–7, 98–9, 168–74
  - in ring-porous trees 44–5, 59–60, 172–3, 175
  - rings 7, 43–6, 58, 159, 166–8, 258
  - secondary 7, 36–7, 38, 40, 99–100
  - speed of 157–9
  - strategies 59–63, 170–4, 178
  - water effects 161–2, 163–4, 165, 166
- Guarea* 12
- guelder rose *see* wayfaring tree
- gums 43, 239–40, 242, 244
- Gymnocladus dioica* *see* Kentucky coffee tree
- gymnosperms *see* conifers
- hairs 17, 90, 234, 235
- handkerchief tree *see* dove tree
- hardwoods
  - branch shed 199–200
  - buds 65–6, 176
  - defined 4
  - diffuse-porous trees 44–6, 48–9
  - drying 53–4
  - evolution 5
  - exceptions 4, 43
  - growth rings 43, 44–5, 46
  - gums 239–40, 242
  - heartwood 242–3
  - reproduction 112, 114–21, 141, 142–3, 144–7
  - ring-porous trees 44–6, 49–50
  - root growth 94, 101
  - shape 187, 188–9, 206
  - structure 41, 42–3, 48–9, 242, 243, 244
  - taxonomy 2–3
  - tension wood 69–70, 108
  - water movement 47–50
- hawthorn
  - damage by 80
  - flood tolerance 104
  - flowers 117
  - fruit 117
  - fungus 262
  - salt damage 262
  - seeds 140

## **Trees:** Their Natural History

- hawthorn—*cont.*
  - spines 197, 234
  - temperature 177
  - trunk 40
- hazel 65, 104, 117, 132–3, 143, 181, 217, 247, 260
- health of trees 8, 82–5, 231–2, 259–64
- heartwood 36, 37, 54, 55–6, 242–4
- heather 22, 98, 216, 219
- Hedera* spp. *see* ivy
- height of trees 157–9, 162, 163, 178, 179
- hemlock 2, 68, 133, 164, 209, 260
- herbicides 82, 211
- Hercules' club 33
- Hevea brasiliensis* *see* rubber tree
- hiba 198, 211
- hickory 91, 170, 171, 172, 184
- Hippophaë* spp. *see* sea-buckthorn
- hollow trees 244–5, 252–3
- holly
  - as firewood 250
  - flood tolerance 104
  - flowers 118, 138
  - fruit 118
  - fungus 262
  - leaves 16, 28, 29
  - seeds 214, 218
  - spines 232, 234
  - taxonomy 4
- honey-locust 90, 177, 181, 197, 234
- honeysuckle 219
- hop hornbeam 30
- hormones 70, 102, 163, 175, 206
- hornbeam
  - clipping 211
  - damage by 80
  - flowers 118
  - frost damage 247
  - fruit 118
  - growth patterns 170
  - leaves 14
  - pollution 246, 260
  - seeds 183, 218
- horse chestnut
  - buds 169, 202
  - damage by 79
  - flowers 112–13, 118, 200, 202
  - fruit 118, 144
  - growth patterns 170
  - leaves 13, 33
  - salt damage 261
  - seeds 183, 216, 217
  - width 159
- horsetail 3
- hybridisation 226–7
- Ilex* spp. *see* holly
- Indian laburnum 19–20, 127
- insects
  - damage 64, 103, 165, 231, 234–5, 238, 239
  - as defence 235
  - pollination 112–22, 125–9, 133–6
  - seed dispersal 153
- ironwood, desert 26
- ivy 14, 29, 208, 218, 231, 232, 262
- jojoba 16
- Joshua tree 3, 40, 59
- Judas tree 138
- Juglans* spp. *see* butternut; walnut
- juniper
  - buds 169
  - flowers 121
  - fruit 121, 142
  - growth patterns 171
  - leaves 23, 27
  - mycorrhizas 91
  - pollution 246, 261
  - seeds 138, 214
  - taxonomy 2
- Kalmia* spp. *see* laurel, mountain; laurel, sheep
- kapok tree 124, 151, 154
- katsura tree 84

## Index

- Kentucky coffee tree 33, 90
- King's holly 258
- Krummholz 190, 191
- laburnum 81, 118, 143, 227
- Lagarostrobus franklinii* see pine, Huon
- lammas growth 21, 172, 173
- Lantana* 113
- larch
  - buds 197
  - frost damage 260
  - growth patterns 171
  - hybrids 226–7
  - leaves 13, 14, 28
  - light requirements 164
  - pollination 133
  - pollution 261
  - sap 57
  - seeds 183, 219
  - taxonomy 2
- Larix* spp. see larch
- Larrea tridentata* see creosote bush
- latex 43, 240
- laurel
  - bay 6
  - camphor 28, 243
  - cherry 14, 104, 236, 263
  - mountain 125
  - sheep 126
  - spurge 120
- Laurus nobilis* see laurel, bay
- leaves
  - absorption 7, 18
  - arrangement of 196, 208–11
  - chlorophyll 13, 25, 31–3
  - colour 31–3
  - compound 12, 33–4
  - deciduous 28–30
  - drip tips 22
  - evergreen 28–30
  - exchanging 28–9, 30
  - food production 7, 9, 31
  - guttation 17, 46
  - modifications 24, 25–6
  - movement 18–21, 209
  - needles 23
  - phloem 12, 23
  - photosynthesis 9, 13, 16, 18, 20, 22, 24, 25
  - scales 17, 23, 24, 26, 168–9
  - shade 15, 208–11
  - shape 21–6, 33–4
  - shedding 28–9, 30–1, 177, 209
  - size 9, 21, 22, 25
  - stomata 13, 14, 16–17
  - structure 9, 12–13, 14, 24, 25
  - temperature effects 15–17, 20, 22, 29
  - transpiration 13, 15–18, 20, 22, 33, 47
  - in water movement 46–7
  - xylem 12, 23
  - see also* bracts; needles; stipules
- lemon 146
- liana 1, 40, 101, 157, 237
- Libocedrus decurrens* see cedar, incense
- lifespan of trees *see* age of trees
- light 20, 164, 175, 188–9, 206, 208–11, 215
- lignin 7, 41
- Ligustrum vulgare* see privet
- lilac 81, 101, 262
- lime
  - bark 60, 61
  - buds 65, 169
  - damage by 79
  - flowers 112, 118
  - frost damage 260
  - fruit 118, 145
  - growth patterns 171, 173
  - leaves 14
  - salt damage 262
  - seeds 183, 218
  - shape 187, 189
  - size 159, 160
  - temperature 247
- Lipidendron* see clubmoss
- Liquidambar styraciflua* see sweet gum
- Liriodendron tulipifera* see tulip tree

## **Trees:** Their Natural History

- Litchi chinensis* see lychee
- Lodoicea maldivica* see coconut, double
- Lomatia tasmania* see King's holly
- Lonicera periclymenum* see honeysuckle
- lychee 172
- 
- Maclura pomifera* see orange, osage
- madrone 63
- magnolia 5, 25–6, 28, 77, 91, 112, 113, 173, 200
- Mahonia* spp. see Oregon grape
- maidenhair tree
  - durability 265
  - evolution 3, 5
  - growth patterns 171
  - holiness 6
  - knobs 109
  - leaves 4
  - mycorrhizas 91
  - pollination 133, 141, 142
  - pollution 246, 261
  - salt damage 262
  - taxonomy 2
- Malus* spp. see apple
- Mangifera indica* see mango
- mango 154, 172
- mangrove 17, 106, 107
- mangrove, red 59, 89
- man's effect on trees 83–7, 165–6, 206–7, 211, 215, 265
- maple
  - branch drop 200
  - damage by 79
  - flood tolerance 105
  - flowers 200
  - fruit 145, 150
  - growth patterns 170
  - leaves 30, 33, 209, 210
  - light requirements 164
  - mycorrhizas 91
  - pollution 260
  - reproduction 138, 139, 140, 154
  - roots 97, 1101
- salt damage 261
- sap 45, 47
- seeds 183, 216
- masting 55, 147–50, 224
- Melaleuca* see bottlebrush
- Meliaceae 33
- meristem 36, 98–9, 168, 200, 201
- mespil 140
- mesquite 33, 76
- Metasequoia glyptostroboides* see redwood, dawn
- Metrosideros* spp. 109
- Metroxylon sagu* see palm, sago
- mezereon 120
- Mimosa pudica* see sensitive plant
- minerals 7, 9, 18, 90, 92, 93, 164–5
- monkey puzzle tree 3, 4, 5, 6, 28, 41, 65, 91, 263
- monocotyledons 2–3, 8, 40, 59, 107
- mountain ash 80, 104, 112, 136–7, 217
- Musa* spp. see banana
- mutations 32, 226, 228, 238
- mycorrhizas 90–3, 246
- Myrica gale* see bog myrtle
- Myristica fragrans* see nutmeg
- myrrh 239
- myrtle 95
- nectar 122, 124, 125–6, 135–6, 138
- needles 4, 9, 23, 55, 174, 197, 200
- Nerium oleander* see oleander
- nitrogen 18, 90, 93–4, 95–6, 164, 165, 246
- Northofagus* spp. see beech, Southern
- nutmeg 6
- nutrition 7, 18, 31, 90–8, 164–5, 246
- Nyssa aquatica* see tupelo
- 
- oak
  - bark 61, 62–3, 64
  - branch shed 199, 200
  - buds 64–5, 197, 198
  - chemical defences 236–7
  - damage by 79

## Index

- flowers 119, 129, 130, 139, 141, 154, 178, 179
- frost damage 247, 260
- fruit 119 *see also* acorns
- fungus 262
- grafting 192
- growth patterns 44, 170, 172, 175, 252
- heartwood 242
- holiness 6
- leaves 9, 13, 14, 17, 21, 28–9
- masting 147–8, 149
- pollution 246, 261
- roots 74, 76, 77, 78, 81, 90, 101
- salt damage 261
- sapwood 56
- seeds 184, 213, 217, 221, 223, 224
- size 157, 158, 160
- water movement 49, 51
- Ochroma pyramidalis* *see* balsa
- oils 6, 9, 43, 243, 250
- Olea* spp. *see* olive
- oleander 14
- olive 16, 17, 22, 91, 172
- Olneya tesota* *see* ironwood, desert
- orange, mock 104
- orange, osage 56
- Oregon grape 125, 262
- osier 176
- Ostrya virginiana* *see* hop hornbeam
- oxygen 9, 101, 103, 107
- palm
  - cabbage 3, 40, 59
  - carnauba wax 13
  - oil 6
  - raffia 9
  - rattan 26, 159–60
  - sago 55
  - taxonomy 2, 3
  - traveller's 3, 9, 10, 124
  - width 40
- palo-verde 33
- Pandanus* spp. *see* pine, screw
- papaya 6
- Parashorea malaanonan* 256
- parasites 226, 231
- Parkia* spp. 152
- Parthenocissus quinquefolia* *see* Virginia creeper
- Passiflora* spp. *see* passion flower
- passion flower 235
- Paulownia tomentosa* *see* foxglove tree
- peach 103
- pear 105, 119, 147
- pecan 90
- Persea americana* *see* avocado
- persimmon 139
- Petalostigma pubescens* *see* quinine bush
- Philadelphus gordonianus* *see* orange, mock
- Phoenix* spp. 107
- phosphorus 90, 92, 164
- photosynthesis 9, 16, 18, 22, 25, 164, 165
- Phyllocladus alpinus* *see* pine, celery-topped
- Picea* spp. *see* spruce
- pine
  - bristlecone 28, 159, 256, 257, 266
  - canary 65
  - Caribbean 172
  - celery-topped 24, 25
  - Corsican 246
  - dendrochronology 168
  - evolution 5
  - fruit 154
  - growth patterns 172, 174, 175, 180
  - growth rings 159
  - Huon 258
  - Japanese umbrella 24, 25
  - jeffrey 151, 239
  - Kauri 138
  - leaves 24, 25
  - light requirements 164
  - limber 257
  - loblolly 100, 172
  - lodgepole 154
  - longevity 256, 257, 258, 266
  - longleaf 250

## **Trees:** Their Natural History

- pine—*cont.*
  - maritime 262
  - masting 149
  - Mexican white 54
  - Monterey 172, 182
  - needles 23, 28, 197, 200
  - New Caledonian 140
  - pinyon 23, 149, 182
  - pollution 246, 261
  - ponderosa 182, 239, 257
  - red 23
  - reproduction 140, 141, 142, 154, 155 *see also* seeds
  - resin 236, 239
  - roots 76, 100
  - salt damage 262
  - sap 54
  - Scots 61, 121, 154, 159, 168, 172, 180, 182, 255
  - screw 2, 40, 107
  - seeds 141, 149, 151, 182, 216, 217–18, 221, 223, 250
  - shape 189, 190
  - shortleaf 172
  - soil preference 166
  - stone 189, 190, 262
  - sugar 54
  - taxonomy 2
  - Weymouth *see* pine, white
  - white 174, 175
  - width 40
  - Wollemi 5
  - pith 36, 37, 38
  - plane 63, 80, 159, 173, 199, 245–6, 248, 261
  - planting trees 77–8, 87, 164
  - Platanus* spp. *see* plane
  - plum 142, 146, 205, 225
  - Poaceae *see* bamboo
  - Podocarpus* spp. *see* yellow-wood
  - pollarding 65–6, 139
  - pollination 112–40, 154–5
  - pollution 90, 165, 245–6, 259
- poplar
  - branch drop 199, 225
  - damage by 79
  - flowers 119, 138, 139
  - frost damage 260
  - fruit 119
  - growth patterns 171
  - leaves 14
  - pollution 261
  - roots 101
  - seeds 151, 181
  - suckers 225
- Populus* spp. *see* aspen; Eastern cottonwood; poplar
- potassium 164
- prickles 234
- privet 28, 112, 119, 211, 262
- propagation 199, 211, 225–8
- Prosopis* spp. *see* mesquite
- Proteaceae 90, 123, 248
- pruning 69, 78, 85, 199, 211
- Prunus* spp. *see* almond; apricot; blackthorn; cherry; laurel, cherry; peach; plum
- Pseudotsuga* spp. *see* fir, Douglas
- Purshia* spp. 95
- Pyracantha* spp. 234
- Pyrus* spp. *see* pear
- Quercus* spp. *see* oak
- quince, Japanese 25
- quinine 6, 59
- quinine bush 152–3
- Raphia farinifera* *see* palm, raffia
- Ravenala madagascariensis* *see* palm, traveller's
- reaction wood 68–70, 207, 256
- redwood
  - branch shed 200
  - buds 196, 198
  - coastal 41, 65, 141, 158, 159, 162, 198, 200, 256
  - dawn 4, 5, 12, 28, 196, 198, 200

## Index

- evolution 5
- growth patterns 171
- height 158, 159
- leaves 12–13, 23
- longevity 256, 257
- mycorrhizas 91
- seeds 151, 181
- taxonomy 2
- water requirements 162
- wood structure 41
- resin 41, 42, 43, 236, 239, 242, 244
- Rhamnus* spp. *see* buckthorn
- Rhizophora mangle* *see* mangrove, red
- rhododendron 4, 17, 18, 20, 28, 105, 119, 219, 236
- Rhus* spp. *see* sumac; varnish tree
- Ribes* spp. *see* blackcurrant; currants
- ring-porous trees 44–6, 49–50, 55, 56, 59–60, 172–3, 175, 264
- Robinia pseudoacacia* *see* false acacia
- roots
  - collar 98, 100, 108
  - damage by 77–8, 80, 87–9
  - death 82–5, 102–3
  - fine 78–9, 81–3
  - food storage 7, 72, 98
  - grafting 94, 97–8
  - growth 38, 98–102, 174–5, 253
  - hairs 90
  - lateral 74, 76–7, 97, 101, 254
  - lenticels 100, 106–7
  - modifications 2, 90, 100, 106–9, 192
  - mycorrhizas 90–3, 94
  - nitrogen fixing 90, 93–4, 95–6
  - nodules 93–4, 95–6
  - in nutrition 7, 72, 88–98
  - plate 72–6, 253–5
  - primary growth 98–9
  - pruning 78, 85
  - secondary growth 99–100
  - shoot ratio 72, 102, 163–4, 174
  - sinker 74, 75
  - size 72, 75, 78–83
- structure 38, 90, 99–100
- suberisation 99–100
- tap 72, 74, 75, 76
- temperature effects 101, 103
- and tree health 83–7
- in water movement 46–7, 48, 90, 99
- water requirements 88, 89
- rose 105, 119, 140, 147, 233, 234
- rot *see* decay
- rowan 80, 104, 112, 136–7, 217
- rubber tree 6–7, 101, 153, 172, 240
- Rubus* spp. *see* blackberry; cloudberry
- Ruscus aculeatus* *see* butcher's broom
- Salix* spp. *see* osier; willow
- salt 17, 190, 222, 246, 261–2
- Sambucus nigra* *see* elder
- sandalwood 243
- Santalum album* *see* sandalwood
- sap 46–7, 54, 56–8
- sapwood 37, 54, 55, 56, 242–4
- scales
  - bud 26, 168–9, 170, 195–6, 197–8, 200
  - leaf 17, 23, 24, 26, 168–9
  - scars, girdle 195–6, 200, 201
- Schefflera* spp. 109
- Sciadopitys verticillata* *see* pine, Japanese umbrella
- “sea-bean” 153
- sea-buckthorn 96, 120
- seeds
  - apomictic 140–1
  - containers 142–7, 150–1
  - dispersal 144, 146, 150–4, 222, 223, 248–9
  - dormancy 213–15
  - food storage 213, 222
  - germination 213–15, 220, 221
  - predation 139, 149, 220, 223, 224
  - in serotinous trees 141, 216, 248–50
  - size 216–20, 222–3
  - storage 141, 215–16, 248–50
  - structure 213, 214, 221

## **Trees:** Their Natural History

- seeds—*cont.*
  - survival 220, 222, 223–4, 246
  - temperature effects 213–14
  - timing 181–5
- semaphore tree 20
- sensitive plant 19, 20–1
- sequoia
  - bark 63
  - branch drop 200
  - buds 198
  - fungus 263
  - holiness 6
  - longevity 256, 257
  - seeds 141, 181, 216, 219
  - size 158, 159, 160
  - temperature 248
- Sequoia sempervirens* see redwood, coastal
- Sequoiadendron giganteum* see sequoia
- serotinous trees 141, 216, 248–50
- shade 15, 164, 179, 208–11, 222
- shape of trees
  - characteristic 7–8, 187–9, 194–5
  - climate effects 188–91
  - controlling 196–200, 204–7
  - gravity effects 192–4
  - in maturity 178, 179, 207–8, 265–6
  - structure effects 194–204
  - wind effects 188, 189, 190–1, 250–2
- she-oak 25, 95, 216, 248–9
- Shepherdia* spp. 96
- shoots
  - epicormic 265–6
  - fasciated 25
  - growth 170–2, 174, 200, 201
  - root ratio 72, 102, 163–4, 174
- Shorea* spp. 132, 256
- silk cotton tree 124, 151, 154
- Simmondsia chinensis* see jojoba
- size of trees 1, 157–62, 265
- snowberry 120
- softwoods *see* conifers
- soil 82–4, 87, 166, 223, 246
- Sorbus* spp. *see* mountain ash; rowan; whitebeam
- Spanish moss 236
- spindle tree 112, 120, 143–4
- spines *see* thorns
- sports *see* mutations
- spruce
  - buds 197
  - compression wood 70
  - flowers 154
  - frost damage 260
  - leaves 28
  - roots 76, 102
  - salt damage 262
  - seeds 141, 182, 219
  - shape 188, 197
  - size 159, 179
  - taxonomy 2
  - temperature 247
- stipules 12, 24, 25–6, 169, 233, 234
- strawberry tree 120
- suckers 65, 224–5, 256
- sugars *see* food production
- sulphur dioxide 246, 260–1
- sumac 33, 139
- sweet gum 21, 91, 171, 173, 183, 190, 225, 239–40
- sycamore 76, 151, 217, 261
- symbiosis 90–4, 95–6, 231
- Symporicarpus albus* *see* snowberry
- Syringa vulgaris* *see* lilac
- tamarind 19
- tamarisk 17, 262, 263
- tannin 59, 236–7
- Taxodium distichum* *see* cypress, swamp
- Taxus* spp. *see* yew
- tea plant 6, 102, 172, 178
- teak 154, 165, 178, 184
- Tectona grandis* *see* teak
- telegraph tree 20
- temperature
  - damage to trees 246–9

## Index

- growth affected 101, 103, 165, 166, 168, 174–8
- and leaves 15–17, 20, 22, 29
- seed germination 213–14
- and water movement 46
- Terminalia* spp. 107
- Theobroma cacao* see cocoa tree
- thorns 24, 26, 197, 232–4
- Thuja* spp. see cedar, western red; cedar, white
- Thujopsis dolabrata* see hiba
- Tilia* spp. see lime
- Tillandsia usneoides* see Spanish moss
- transpiration 13, 15–18, 20, 22, 33
- tree ferns 2, 3, 40
- tree-of-heaven 33, 138, 263
- Trema micrantha* 157
- trunk
  - abnormalities 64–6, 67
  - collaring 66, 67, 68, 69
  - defending 238–45, 264
  - epicormic buds 64–6
  - food storage 7, 36, 54–5
  - grain 53
  - growth 36–40
  - growth rings 43–6
  - movement 53–4
  - phloem 36, 38
  - rays 36, 41, 42, 43, 44, 54–6, 60, 244
  - water movement 36, 41, 46–53
  - width 40, 162
  - xylem 36, 38
  - see also bark; branches; heartwood; sapwood
- Tsuga* spp. see hemlock
- tulip tree
  - buds 169, 171, 177, 196
  - fruit 150
  - leaves 25–6, 27
  - mycorrhizas 91
  - roots 100
  - seeds 183
  - shape 207
  - size 159
- tupelo 103, 107, 173
- twigs 34, 36, 37, 195–6, 198, 200, 225 see also branches
- Ulex* spp. see gorse
- Ulmus* spp. see elm
- uses for trees
  - environmental 7, 9, 16
  - food 6, 55, 126, 237
  - holiness 6
  - incense 239, 243
  - as materials 16, 57, 124, 239, 243
  - medicinal 6, 59, 237, 238
  - nurse plants 7
  - timber 6, 46
- varnish tree 239
- Vateria indica* 98
- Viburnum* spp. see wayfaring tree
- vine 26
- Virginia creeper 26
- Vitis* spp. see grape; vine
- walnut
  - beating 207
  - chemical defences 236
  - damage by 81
  - flood tolerance 105
  - frost damage 260
  - fruit 143
  - fungus 262
  - growth patterns 170
  - mycorrhizas 91
  - pollination 136
  - pollution 260
  - roots 102, 174
  - seeds 181, 217
  - temperature 247
- water
  - absorption 7, 18
  - growth affected 161–2, 163–4, 165, 166
  - loss see transpiration
  - seed dispersal 153–4

## **Trees:** Their Natural History

- water movement
  - air problems 48–50
  - cavitation 48, 49
  - in conifers 41, 48–9
  - in diffuse-porous trees 48–9
  - in hardwoods 48–50
  - hydraulic segmentation 50–3
  - by leaves 46–7
  - in ring-porous trees 49–50
  - by roots 46–7, 48, 99
  - and temperature 46
  - by xylem 36, 46, 47
- wayfaring tree 117, 123, 170
- Welwitschia mirabilis* 2, 10, 11, 18, 133
- whitebeam 80, 121, 140
- width of trees 40, 159, 160
- willow
  - branch drop 225
  - buds 171
  - damage by 79, 82
  - flood tolerance 103
  - flowers 118
  - fruit 121
  - fungus 262
  - growth patterns 171, 208
  - leaves 9, 10, 16
  - pollution 261
  - reproduction 138, 139
  - roots 76, 106
  - salt damage 262
  - seeds 181
- temperature 247
  - see also* catkins
- wind
  - damage 250–6
  - pollination 114–15, 117–21, 129–34, 136, 137, 140
  - seed dispersal 150–1, 222
  - shape affected 188, 189, 190–1, 250–2
- witches' brooms 226, 231
- Wollemia nobilis* *see* pine, Wollemi
- wood *see* branches; trunk
- Xanthorrhoea* spp. *see* grass trees
- yellow-poplar *see* tulip tree
- yellow-wood 138
- yew
  - buds 198
  - flowers 121, 138, 139
  - fruit 121, 143
  - fungus 263
  - growth rings 45, 159
  - longevity 257, 258–9
  - needles 16, 28
  - seeds 142, 143, 214
  - shape 211
  - soil preference 166
  - taxonomy 2
  - width 40, 160
  - wood 4, 41
- Yucca brevifolia* *see* Joshua tree