

Index

A

Adaptation 38–39, 70
Aesthetics 4, 96
Agriculture/agroecosystems 9, 19, 36–37, 44, 53–68, 70, 110, 122, 125, 133, 149–162, 163, 164, 166, 182, 194, 234
 biodiversity 54–56, 66, 67
 carbon storage 54, 55, 67, 68
 contribution to GDP 60, 61
 crop diversity 56
 Cuba 159–162
 economic value of production 60, 61
 extent 54–57
 fertilizer 48, 58–59 (map), 62, 64, 66, 67, 159, 161
 food production 4, 53–55, 60, 64, 66
 historical perspective 6–7
 inputs 60, 62, 159
 intensification 53, 56, 58–60, 67, 112
 intercropping 160, 162
 Machakos 149–158
 output/productivity 4, 53, 108, 155, 160, 162, 196, 221
 pesticides 48, 56, 59, 66, 67, 159, 161
 populations 53–55, 58, 60
 soil degradation 53, 59, 60, 62, 63 (map), 64
 Taking Stock (scorecard), 54–55
 urban agriculture 39, 56, 162
 water quality 54–55, 64
 water quantity 54–55, 64, 162
 yield 60, 62, 64, 65 (map), 160
Agroforestry
 Indonesia 36–37
 Sumatra 22
Air pollution 27, 88–89, 122, 124, 135, 142, 145
 sulfur dioxide 27, 135, 142, 178
 nitrogen oxides 27, 135, 142, 178
 ozone 27, 135, 142, 178
Algal blooms 5, 21, 27, 51, 70, 73, 77, 104, 112, 170, 173
Alterations of landscapes 4. *See also* Conversion
Amphibian declines 51, 116, 117
Antarctic 136–140
Aquaculture 28, 48, 70, 79, 81, 83, 113–116, 144, 179, 208
Aral Sea 64, 106
Arable land per capita 4, 150
Arctic 50, 51, 136–140

B

Ballast water discharges 82
Baltic Sea 11
Biodiversity 14, 17, 48, 229
 in agroecosystems 54–56, 66–67
 in coastal ecosystems 70–71, 75, 82–83, 170–171
 in forest ecosystems 88–89, 91, 92, 99
 in freshwater systems 104–105, 115, 116–118, 193, 203, 208
 in grassland ecosystems 120–121, 125–126, 129, 130 (map), 131–132
 in mountain ecosystems 134–135
 in polar ecosystems 137
 in urban ecosystems 142–144
Bioinvasion. *See* Invasive species and Nonnative species
Biological pest control 160
Birth rates 7
Black Sea 4–5

Bolinao, Philippines 178–180, 233, 236
Buffers 144, 176, 210–211

C

Carbon cycle 15, 67, 99
Carbon dioxide 22, 67, 79, 140, 145
 emissions 15, 23, 88, 89, 101, 124, 137, 178
Carbon storage/sequestration 15, 48, 49 (map)
 in agroecosystems 48, 54–55, 56, 66–67
 in forest ecosystems 15, 48, 88–89, 99, 131
 in freshwater systems 106
 in grassland ecosystems 48, 120–121, 131
 in polar ecosystems 36
 in soil 15, 53–54, 67–68
Cement industry 178
Cereal 60
 consumption 28
 production 50, 62
Chemical cycles 50, 56
 carbon 15, 50, 67, 99
 freshwater 50, 64, 166, 170
 nitrogen 50
Cities. *See* Urban
Citizen advocacy 178
Climate change. 15, 22, 41, 50, 76, 79, 92, 136–138, 140, 237. *See also* Global warming and Temperature changes
 rising sea levels 50, 70–71, 79, 137
Coastal ecosystems 9, 19, 44, 50, 51, 69–85, 106, 163–180
 aquaculture 70, 79, 81, 83
 biodiversity 70–71, 75, 82–83, 170, 171, 176
 Bolinao, Philippines 178–180
 condition 79–81
 coral reefs 69, 70, 72, 75, 79, 80, 83, 85, 168, 179
 employment 79, 84
 Everglades 163–175
 extent 69–72
 fisheries 70, 74–75, 78–81, 83
 harmful algal blooms 48, 81–82
 hypoxia 77 (map), 81–82
 mangroves 69, 70, 72, 74, 82–83, 85, 164, 168, 176–177
 Mankotè 176–177
 modifications 72
 pressures
 climate change 76, 83, 237
 overharvesting 76, 78, 81–82
 pollution 70, 72–74, 76–77, 81–82, 85
 population 70, 72, 73, 179
 trawling 76, 79, 80
 production 70–71
 shoreline protection 70–71, 75, 83–84, 176
 Taking Stock (scorecard) 70–71
 tourism and recreation 70–71, 81, 84–85
 water quality 70–71, 81, 167
 water quantity 70–71, 164
Community management/involvement 11, 158, 199, 233, 236
 Bolinao 178–180
 Dhani Forest 181, 182, 185, 190
Conservation 34–35, 199, 205, 210
Consumption 22–23, 28–29, 60, 141, 145
 fish 28, 81
 geography of 28

Index

grains 28, 221
meat 28, 60
wood 28

Conversion 4, 6–7, 24–25, 167
to agricultural 17, 22, 24, 41, 56, 66–67, 122, 192, 194, 214
of forests 6, 10, 16, 48, 66, 88, 92, 93, 208
of grasslands 7, 122, 131–132, 220
of mountain ecosystems 135
to urban and industrial 12, 22, 24

Coral reefs 16, 69, 70, 72, 75, 79, 80, 83, 85, 168, 179
Bolinao, Philippines 178–180

Corruption 33

Crops 16, 58, 144, 153, 154, 157, 158, 159, 162
continuous cropping/cultivation 152
diversity 54–55, 64, 155
land area 56
shifting cultivation/rotation 101, 152, 161
yields 50, 152, 160, 162. *See also* Agriculture yields

Cuba 159–162

D

Dams 16, 48, 51, 103, 104, 106, 108–109, 114–115, 206, 208–209

Data quality 55, 71, 89, 103, 121, 234–235

Dead zone 27. *See also* Hypoxia

Deforestation. *See* Forest ecosystems

Degradation 5, 6–7, 38, 90, 99, 116–117, 120–122, 149, 152, 213–214

Desalinization 12, 202

Desertification 6, 216, 220, 221

Dhani Forest 181–192, 226, 236, 237, 238

Drinking water. *See* Water supply

Droughts 137, 145, 149–150, 152, 157, 166, 173, 217, 223

E

Economics 22, 30, 107, 150, 158–159, 164, 177, 178, 182, 194, 206, 209, 211, 213–214, 219–221, 223
ecosystems and 4, 20–21, 23
GDP 60–61, 84, 92, 202, 206, 213, 221
GNP 159, 213

Ecosystem approach 10–11, 40–41, 225–239

Ecosystems 11
assessments 45–46, 234–235
capacity 544, 51, 96
categories 11, 46
condition 79
direct benefits of 11
goods and services 4, 9, 11, 21, 23, 30, 32, 41, 44, 47, 51, 69, 87, 90, 96, 103, 119, 126, 129, 136, 142, 203, 205
indirect benefits of 11
management of 16, 40–41, 50, 206, 226
pressures 16–18, 28, 40, 44, 47, 51
scorecards 47, 54–55, 70–71, 88–89, 104–105, 120–121
valuing/value of 30, 32, 203

Ecotourism 34–35, 84, 203, 204

El Niño 45, 75, 79, 83, 92, 96, 156–157

Employment 4, 11, 60, 79, 152, 155, 158–159, 196, 199, 201, 204–205

Endangered species. *See* Threatened and endangered species

Energy 88–89, 93, 142

Equity 150, 176, 194, 214, 221. *See also* Land tenure.

Erosion 85, 157, 176, 223. *See also* Soil erosion

European Union 228

Eutrophication 21, 27, 48, 50, 73, 77, 81, 104, 112–113, 115

Everglades 163–175, 229, 232–233, 236

Extinction 7, 13, 14, 17, 51, 88, 99, 115, 178

F

Farming. *See* Agroecosystems

Fertilizers 30, 31, 48, 50, 58–59(map), 62, 64, 66–67, 69, 110, 158–159, 161, 184

Filtration, water. *See* Water

Fires 122, 124(map), 132, 166, 193, 214

Fisheries/fishing 10, 26, 45, 53, 104–105, 115–116, 139, 164, 178, 235
aquaculture 28, 48, 70, 76, 79, 81, 83, 104, 113, 114
Aral Sea 64, 106
Black Sea 4–5, 15, 82
Bolinao 178–180
bycatch 76
collapse 10, 115, 116
depletion of stock 79, 139
destructive practices 16, 76, 178
freshwater 104–105
inland 104–105, 113–116
Lake Victoria 21
marine 74, 75, 79
overfishing 21, 76, 78, 114, 115, 139
production 48, 70–72, 79, 113

Floods 5, 48, 84, 101, 106–107, 144, 164–165, 167, 208

Food production 45–46, 48, 51, 107
in agroecosystems 4, 53–55, 60, 64, 66
in coastal ecosystems 70–71, 79
in freshwater systems 104–105, 113, 116, 118
in grassland ecosystems 120–121, 125–126, 128–129
in mountain ecosystems 133–134
in polar ecosystems 139
in urban ecosystems 144
soil degradation, impact of 64

Forest ecosystems 5, 19, 44, 51, 56, 87–102, 106, 122, 150, 181–192, 194, 214
biodiversity 88–89, 91–92, 99
carbon storage 15, 88–89, 99, 131
deforestation and forest loss 10, 30, 37, 48, 50, 88–89, 90–91, 98, 102, 115, 135, 150, 208
distribution 88–89
extent 88–89, 90–91, 202
fires 92, 96–97(map), 214
fragmentation 16, 88, 90, 92, 94–95(map), 99
fuelwood 10, 90, 181, 184, 190, 196, 204, 214
India, Dhani 181–192, 226, 236, 237, 238
non-timber forest products 99, 184, 189–190, 192
plantations 88–89, 92, 93, 198
population 88–90
production 88–89, 92–93, 98
Taking Stock (scorecard) 88–89
timber 36, 88–89, 133, 184, 188–189, 204, 220
harvest 6, 16, 92–93, 186
industry 92–93
production 88–89, 92
tropical 48, 101, 131
urban forests 142–143
water quality 88–89, 101–102

water quantity 88–89, 101–102, 184
 watershed protection 88–89, 102
 woodfuels 88–89, 90–91, 93, 98 (map), 99, 196
Fossil fuels 15, 50
Fragmentation 67, 106, 143
 of forest ecosystems 16, 88, 90, 92, 94–95 (map), 99
 of freshwater systems 108–109 (map), 122–127 (map), 129
Freshwater systems 9, 19, 44, 50–51, 62, 64, 103–118, 150, 164, 182, 193–211, 214
 biodiversity 104–105, 115–118
 carbon storage 106
 extent 103, 106–107
 food production 104–105, 113, 116, 118
 fragmentation and flow 108–109 (map)
 Index of Biotic Integrity (IBI) 112, 134
 inland fisheries 113–114 (map), 115–116
 Mekong Basin 113, 206–209
 New York City watershed 210–211
 rivers 103, 106
 South Africa 193–205
 Taking Stock (scorecard) 104–105
 water quality 104–105, 110–111 (map), 112
 water quantity 104–105, 107, 110–111 (map), 112
 wetlands 112
Fuelwood 74, 181, 184, 196

G

Garbage. *See* Solid waste
Genetic resources 11, 14, 17, 51, 53, 66–67, 99, 133, 134
Glaciers 79
GLASOD 62, 64, 129
Global warming 22, 29, 70, 134, 139, 140
Globalization 237
Goods and services, ecosystem. *See* Ecosystem goods and services
Government policies 231
Government subsidies. *See* Subsidies
Grain consumption. *See* Consumption
Grassland ecosystems 9, 19, 44, 51, 56, 101, 119–132, 194, 212–224
 biodiversity 120–121, 125–126, 129–130 (map), 131–132
 carbon storage 120–121, 131
 extent 51, 119–123 (map)
 fire 122, 124 (map), 132
 food production 120–121, 125–126, 128–129
 fragmentation 122–125, 126–127 (map), 129
 livestock grazing 122, 125, 128–129, 198, 212–224
 Mongolia 212–223
 population 119–121, 212
 Taking Stock (scorecard) 120–121
 tourism 120–121, 132
Greenhouse gas 48, 67, 140
Gross domestic product (GDP) 60–61, 84, 92, 202, 206, 213, 221
Gross national product (GNP) 159, 213

H

History of ecosystem degradation 6–7
Hydropower 90, 108, 134, 206–209
Hypoxia or hypoxic zones 27, 77, 81–82

I

India (Dhani) 181–192, 226, 236, 237, 238
Indonesia 36–37
Industrialization 159, 189, 216
Information and monitoring 150, 164, 182, 194, 214, 229–232, 234–235
Inland fisheries. *See* Fisheries

Inner Asia. *See* Mongolia
Integrated assessment 46, 230
Intensification 184

 agriculture 53, 56, 58–60, 67, 112
 aquaculture 70, 79, 81
 livestock 179

Invasive species 5, 7, 17, 20, 173, 193, 196–198, 203–205

 agroecosystems
 coastal 70–71, 82
 forests 88, 99
 freshwater 5, 104–105, 115, 11–118
 grasslands 130, 131
 urban 142

Irrigation 30, 31, 41, 48, 50, 58–59, 66, 104, 115, 150, 152, 157, 159, 173, 202, 216, 219
 efficiency 66
 water quantity 50, 64

J

Jobs. *See* employment
Joint forest management (JFM) 192

L

Lake Victoria 21
Land tenure 33, 36–37, 39, 92, 150, 176, 182, 194, 214, 221, 236
 Indonesia 36–37
Land use change, 56, 67, 90, 101, 150
Leidy's comb jellyfish 20, 82
Livestock 26, 144, 152, 155, 212–224
 densities 125, 129, 212, 214, 220, 221–223
 food production 54, 213
 grazing 7, 122, 155, 158, 212–217, 219–220, 224

M

Machakos 149–158, 238
Mangroves 51, 74
 Everglades 164, 168
 losses 74
 Mankòtè 176–177
Mankòtè 176–177, 233
Markets (economy, access) 30–32, 182
Meat consumption 60
Meat production 213, 221
Mekong River/Delta 206–209, 237
Methane 140
Millennium Assessment ix, 237–239
Mining 7, 23, 27, 85, 134, 156
Mongolia 212–224
Mountain ecosystems 133–135
 biodiversity 134–135
 extent 133
 food and fiber production 133–34
 pollution 135
 population 133
 tourism and recreation 135
 water quality and quantity 134

N

Natural areas 142
New York City watershed 210, 211, 233
Nitrogen cycle 50
Nitrogen pollution 27
Nongovernmental organizations (NGOs) 39, 83, 150, 176–179, 205, 208, 233
Nonnative species 17, 21, 48, 94, 99, 100, 104, 106, 115–118, 130, 131, 142, 194, 200, 220

Index

Nutrients 48, 181, 92, 122, 124, 170
 balance 62, 64, 65 (map)
 pollution 48, 62, 76, 77, 110, 157
 runoff 73
 Nutrition 60, 70, 116, 208

O

Oceans
 carbon storage 15
 circulation 50, 79, 137
 climate change 50, 76, 79
 fish production. *See* Fisheries
 overfishing 76, 78 (map)
 sea level rise 50, 79
 Oil spills/pollution 76, 81, 112, 138
 Organic agriculture 159–161
 Ozone
 depletion 7, 138, 237
 pollution, 27

P

PAGE viii, 43–145, 225, 229, 238–239
 Parks and protected areas 34–35, 84, 120, 135, 144, 163, 167, 168, 174, 177
 Pasture 212–224
 Pesticides 193. *See also* Pollution
 Pharmaceuticals 14
 Philippines 178–180. *See also* Bolinao
 Plantations. *See* Forest Ecosystems
 Polar ecosystems 136–140
 biodiversity 137
 extent 136
 food production 139
 pollution 137, 139 (map)
 recreation 139
 regulation of global climate, ocean currents and sea level 136–137
 Pollination 13
 Pollution 16, 22, 27, 41, 48, 50, 59, 62, 70, 81, 104, 115, 116, 134, 135, 144, 177–179, 204
 acid rain 27
 garbage (solid waste) 76, 144
 heavy metals 7, 27, 76, 112
 PCBs 138
 pesticides 27, 30, 31, 41, 59, 64, 82, 112, 115, 193
 POPs (persistent organic pollutants) 82, 137
 radiation 76, 137
 sewage 12, 81, 85, 112
 Poor 48, 93, 113, 222, 226. *See also* Poverty
 Population 22, 26, 38, 60, 69, 110, 112, 191
 growth 22, 24, 90, 107, 112, 152, 158, 184
 Poverty 26, 33, 38–39, 40, 62, 149, 150, 198, 199, 204, 205, 208, 209
 Pressures on ecosystems. *See* Ecosystems
 Property rights 33
 Public participation. *See* Community management/involvement

R

Rangelands
 Africa 128 (map)
 Great Plains U.S. 4, 7
 livestock. *See* Livestock
 Mongolia 212–224

overgrazing 221
 Recreation 51, 211
 in coastal ecosystems 84–85
 in grassland ecosystems 132
 in mountain ecosystems 135
 in polar ecosystems 139
 in urban ecosystems 144
 Recycling 144, 160
 Reforestation 101, 160
 Regulations 31, 185
 Resilience 10
 Resource consumption. *See* Consumption
 Restoration 41, 101, 143, 164, 166, 172, 173, 175, 182, 185, 194, 196, 202, 204, 205
 Rivers 48, 50, 64, 106, 108, 112, 113, 115, 118, 125, 144, 205.
 dams. *See* Dams
 Mekong 206–209
 Roads 92, 94, 120, 125, 126, 141, 144, 156, 205
 Roundwood 93

S

Salinization 6, 53, 58, 59, 62, 66
 Sea level rise. *See* Climate change
 Services/goods. *See* Ecosystems
 Sewage. *See* Pollution
 Shoreline protection 70, 71, 75, 83, 84, 176
 Socialist trade bloc 159, 219, 221
 Soil 3
 acidification of 22
 carbon storage 15
 conservation 7, 67, 152, 158
 degradation 5, 16, 48, 53, 62, 63 (map), 64, 129, 167
 erosion 5, 6, 48, 53, 87, 101, 122, 124, 125, 129, 138, 149, 156, 158, 160, 164, 184, 185, 194, 205
 fertility 59, 60, 152, 160
 pollution 62
 Solid waste. *See* Pollution
 South Africa 193–205
 water policies 193, 198, 200, 201, 232
 Working for Water Programme 193–205, 238
 Spiritual retreat 4, 135
 Stakeholders 150, 164, 182, 194, 214
 Storm surges 50
 Subsidies 30–31, 232–233
 Suburban sprawl 24, 41, 142, 167
 Sulphur dioxide (SO₂) emissions 178
 Sustainability 200
 Sustainable agriculture 149–162
 Sustainable fishing 21
 Sustainable production 93

T

Temperature changes 22. *See also* Global warming
 Tenure, land. *See* Land tenure
 Threatened and endangered species 14, 51, 83, 88, 89, 100 (map), 116–118, 134, 135, 175
 Timber 36, 184, 188, 189, 194. *See also* Forest ecosystems
 Tourism 51, 163, 167, 175
 ecotourism 32, 34–35, 51
 Trade 159 162, 163
 Trade-offs 5, 16, 46, 118, 148, 175, 209, 228–230, 233

Lake Victoria 21, 113
Tundra 22, 50, 51, 106, 122, 136, 138

U

United States
 conversion 4
 New York City 32, 210, 211
 Everglades 163–175
Urban 110, 120, 125, 141–145, 157
 agriculture 39, 144
 air quality 142, 144
 biodiversity 142–144
 conversion 143
 extent 141
 management 144, 145
 open space/green space 142, 145
 populations 226, 141, 166
 recreation 144, 145
 stormwater 144
 water supply 174
Urbanization 24, 26, 51, 60, 120, 125, 126

V

Valuation 30, 32, 203, 232–233

W

Water
 availability 110–111
 conservation 153, 154, 158, 167, 205
 consumption 135
 drinking 12, 101, 104, 110, 210, 211
 filtration, purification 12, 32, 46, 106, 210, 211
 groundwater 16, 66, 104, 107, 112, 144, 150
 irrigation. *See* Irrigation
 monitoring 234–235

pollution 210, 211
 agricultural 164
 from fertilizers 63
 industrial 7, 112
pricing 200, 201
quality 48, 199, 208, 211
quantity 48, 198, 199, 204
safety 12, 48
scarcity 107, 110, 156, 196
subsidies 232
supply 164, 166, 167, 175, 194, 196, 205, 210, 211
treatment 12, 134
use 144, 209
Watersheds 41, 102, 104, 105, 168, 193, 206
 function 22, 88, 89, 122
 management 200, 201, 209, 210, 211
 ownership 211
 protection 11, 101, 198, 199
Weather. *See* Climate change
Wetlands 69, 106, 107, 113, 116, 163–175, 172
 conversion 48, 104, 107, 167
 loss of 51, 82, 107, 164
 value of 12
Wildlife 66, 132, 137, 139, 142–144, 164, 174, 181, 184, 185
Women 154–156, 186, 187, 196, 199
Wood production. *See* Forest ecosystems
Woodfuel 96
Working for Water Programme 193–205

Y

Yunnan province 206

Z

Zebra mussel 20, 118