Index

Note: page numbers in *italics* refer to tables, figures, maps and boxes

acid sulphate soils 6–7, 51–52
    distribution 115
flood plain drainage
    cooperation between farmers and researchers 116–117
drain-water quality 102–103, 104
environmental impact 100–101, 110–112, 113
institutional and policy developments 119–121
lake sediment characteristics 103, 105, 106
land management changes 118–119
soil properties 102, 114–115, 117–118
knowledge gaps 114–115
reclamation 57–58
sugar industry guidelines 119
Africa: mangroves
    ambivalent policies 171
defective regulatory instruments 172–173
    sustainable alternatives 173–174
designated protected areas 167, 168
    Kaw estuary (French Guinea) 167, 169
    Menab mangrove wetland (Madagascar) 169–170
    Northern Rivers 170–171
destruction of forests 3, 4
    exploitation in antiquity 164–165
    heterogeneity of mangrove areas 171
    negative attitudes of white colonialists 165
agriculture: water required for production 294–295
aluminium: in water and soil 102–103
    toxic effects on fish 111–112
Asia: mangroves
    destruction 4, 126–128
    exploitation in antiquity 164
Asian Development Bank 88
assimilative capacity *see* environmental capacity

Australia
    coastal flood plain development 109–110
    coastal flood plain drainage
        Acid Sulphate Soil Management Committee 120–121
        attitudes of sugarcane farmers 115–116
        conference on acid sulphate soils 119–120
        cooperation between farmers and researchers 116–117
        drain-water quality 102–103, 104
        environmental impact 100–101, 110–112, 110–113
        institutional arrangements 110
        lake sediment characteristics 103, 105, 106
        land management changes 118–119
        measurements 101–102
        national strategy 121
        soil properties 102, 114–115, 117–118
        study areas 100, 101
    coastal stewardship for conflict resolution 109
    guidelines
        Local Environment Plans 119
        wise coastal practice agreements 109
    employment and livelihoods
        importance of participatory approaches 108–109
        information lacking on coastal ecosystems 108, 113–115

Bangladesh
    coastal area 61, 63, 239
    polders 241
    Coastal Embankment Project 73–74, 239–240
    employment and livelihoods 7, 242
    land use changes 64
        conversion from rice to shrimp farming 4, 6, 7, 241
Bangladesh continued

- loss of agricultural land 6, 238
- over the 20th century 238–241
- NGOs 283
- rice cultivation: new strategies 73
  - area of study 74
    - average monthly river salinity 76, 80
    - changes in production and income 82, 83
    - conclusions and recommendations 83–84
    - cropping system and water management 75–76
    - environmental impact 82–83
    - experimental set-up 77
    - farmer participation 76–77
    - groundwater fluctuation and salinity 79
    - monitoring of water and soil salinity 77–78
    - previous cultivation practice 74–75
    - rainfall and evaporation pattern 75
    - soil salinity in cropped and fallow lands 80, 81
    - wet and dry season yields 80–82
    - yield assessment 79
  - seasonal variation in land use 240
- shrimp farming
  - associated problems 73
  - environmental impact 69–70, 242
  - gher system 61–62, 62–63, 64
  - impact on field crops 63–65, 66
  - impact on natural vegetation 65, 67
  - impact on occupation and income 68–69, 242
  - survey methodology 62
- zoning
  - achieving consensus 245–246
  - based on land suitability 242–243
  - emerging concept 244–245
  - indicative land zones 246, 247
  - programmes and policies 243–244
- basins, river see river basins
- Bayesian networks see networks, Bayesian
- BMP (best management practice) 8–9
- Borneo see Indonesia
- Brazil: Mangrove Dynamics and Management (MADAM) project
  - background 154–155
  - conservation and management 160–161
  - mangrove products 156
  - crab 155, 157–158
  - fish 158–159
  - molluscs 159
  - research area 155, 157

- Cambodia 279, 281
  - capacity, environmental see environmental capacity
  - capital, social 266–267
- cashew 170
- children, labour of 281
- co-management 160–161, 284
- Coastal Embankment Project (Bangladesh) 73–74, 239–240
- Coastal Habitats and Resource Management (Thailand) 92
- Cockles 148–150, 151
- Code of Conduct for Responsible Fisheries (FAO) 8, 259–260
- codes of conduct
  - disadvantages 8–9
  - sugar industry guidelines 119
  - Thailand 94
  - wise coastal practice agreements 109
  - see also regulation
  - competition 278, 279
- conflicts
  - application of New Institutional Economics in resolution 259, 261–262
  - case study: shrimp farming in India 262–264
  - in designated protected areas 167, 169–171
  - between rice farmers and shrimp producers 49, 93, 242
  - sources 251
  - strategies for resolution
    - coastal stewardship 109
    - resource management domains see under resource management domains
- conservation
  - Mangrove Dynamics and Management (MADAM) project, Brazil 160–161
  - mangrove forests 130, 134–135, 136, 137, 268
  - designated protected areas 167–171
  - marine protected areas 285
  - and poverty 285–286
  - regulatory problems 172–173
  - Convention on Biological Diversity 172
  - crab 155, 157–158
  - criminalization 281
- decentralization 265, 266, 268–270
- decisions: Bayesian networks as support systems see networks, Bayesian
- devolution 265, 266–267
- doi moi (renovation) policy (Vietnam) 30
- drainage, coastal flood plain see under acid sulphate soils
- Drainage Act 1904 (Australia) 110
- drains, secondary and tertiary 110, III
- drought 170

- Earth Summit 194
- Ecological Mangrove Reserve (REMECAM) see under Ecuador: shrimp farming
Index

ecotourism 173

Ecuador: shrimp farming
impact study: Ecological Mangrove Reserve (REMECAM)
artisanal fishery 147–148
cockle gathering 148–150, 151
community responses 150–151
demographics 143–144, 145
methodology 142–143
natural resource use and allocation 146
perceptions of shrimp farming 146
study area 141–142
use and perceptions of mangrove ecosystem 144–146
negative impacts on estuarine resources 10
education and training 137–138 see also under integrated coastal zone management (ICZM)
effluent: standards and regulations 8
employment and livelihoods
changes in livelihood structure 21–23, 25, 68–69
child labour 281
competition and exploitation 278
data collection techniques 19–20
diversity 275–276
economic mobility 44, 45
impact of salinity control see under Vietnam
insecurity 279–280
key trends 296
livelihood diversification 286–290
mangrove dependency case studies see under Ecuador: shrimp farming; Thailand
shrimp farming
rice–shrimp system 42
vs. rice cultivation 7
Sustainable Livelihood Framework 31
vulnerability 50
when productivity falls 24–26
environmental capacity 11
environmental impact assessment 11
exclusion 280–281

fish and fisheries 170–171

Code of Conduct for Responsible Fisheries (FAO) 8, 259–260
contribution to food and livelihood security 295
Ecological Mangrove Reserve (Ecuador) 147–148
effect of acid pollution 57, 59, 100–101, 111–112
effect of tidal sluices 54, 59
fisheries management 284
impacts of river basin changes 298
insecurity of fishermen 279–280
Mahakam Delta study of mariculture vs.
fisheries see under Indonesia
in mangrove areas 130, 158–159
variables used Bayesian network decision support system 211–213
flood plains
drainage of acid sulphate flood plains see under acid sulphate soils
historical development 109–110
institutional arrangements for drainage 110
food
key trends 296
security 295
water required for production 294–295
Food and Agriculture Organization approaches to zoning 194
Code of Conduct for Responsible Fisheries 8, 259–260
FAO Framework for Land Evaluation 178
land-use planning guidelines 180
French Guinea 167, 169
fuel-wood 145
gender: imbalances 281–282
Ghana 279–280, 281, 283
gher shrimp culture system 61–62
Guinea 170
Guinea Bissau 170

heritage, natural: concept 166–167
legal status 172
Honduras 6
incentives 11
India
exclusion 280–281
fishing 279, 280–281, 282, 283
Integrated Coastal Zone Management and Training Project
aims and objectives 250–251
course design 255–256
training framework 252–254
training the trainers 251–252
training tools 254–255
virtual scenario case study approach 252
mangrove protection 268
shrimp farming
application of New Institutional Economics 262–264, 267–270
social impact 7
Indonesia
Mahakam Delta (Borneo) study of mariculture vs.
fisheries
background 219–221
changes in land use 1984–2004 224
data collected 222–224
data processing and analysis 224–225
estimated pond area development 223
Indonesia continued

Mahakam Delta (Borneo) study of mariculture vs. fisheries continued
fisheries: production trends 227, 230–233
mariculture: production trends 225–227, 228, 229, 230
study area 221–222
study conclusions 233–235
tambak integrated shrimp mangrove system 9
information: deficits in knowledge of coastal ecosystems 108, 113–115
institutions: analysis see New Institutional Economics
integrated coastal zone management (ICZM) 9–10
background 250
decentralization and devolution 265–267
implementation 260
limitations with respect to conflict 260–264
in relation to poverty 284–287
training
aims and objectives 250–251
course design 255–256
framework 252–254
inappropriate focus on scientific knowledge 249–250
tools 254–255
of trainers 251–252
uptake at international level 259–260
virtual scenario case study approach 252
International Convention on Wetlands (1971) 166
iron: in water and soil 102–103

Kaw-Roura Swamplands Natural Reserve (French Guinea) 167, 169

labour, child 281
land-use planning
guidelines 178, 180
Mekong Delta study see under Vietnam
conflicts in preference for land use 183, 185, 186
land suitability classification 181
methodology: comparison of approaches used 188–191
methodology: FAO-MCE 180–182, 183, 184
methodology: LUPAS 185, 187, 188
methodology: PLUP 182–185, 186
methodology overview 180
livelihoods see employment and livelihoods
LUPAS (land-use planning and analysis system) 178, 180, 185, 187, 188–191

Madagascar 169–170
management
co-management see co-management
integrated coastal zone see integrated coastal zone management (ICZM)
mangroves
ambivalent policies 171–172
conservation and replanting 130, 134–135, 136
137, 160–161, 268
conflict of interests in designated protected areas 167, 169–171
regulatory problems 172–173
sustainable alternatives 173–174
degradation due to forest concessions 129
ecological functions 146
economic significance 18–19
dependency case studies see under Ecuador:
shrimp farming; Thailand
estimated losses in selected countries 3
heterogeneity of mangrove areas 171
history
exploitation and loss 3, 4, 129
negative attitudes of white colonialists 165
places of residence 164–165
rehabilitation 166
impact of shrimp farming
environmental effects 5, 88
forest destruction 2, 3–4, 126–128, 130, 166
importance for shrimp and fish 61, 234–235
importance of consensus between stakeholders 220
integrated shrimp–mangrove systems 9
a ‘natural heritage’ 163–164, 166–167, 171–172
products 156
 crab 146, 155, 157–158, 170
 fish 146, 147, 158–159
 geographical indicators 173
 molluscs 146, 148–150, 151, 159
 wild shrimp and prawns 147–148
 wood and charcoal 143, 144–145, 160
 social impact of forest destruction 7
 stewardship programmes 150–151
 tourism 173
 use and perceptions of mangrove ecosystem 144–146
Menab mangrove wetland (Madagascar) 169–170
metals: in water and soil 102–103
migrants 280, 281, 282, 283
Millennium Development Goals 294
molluscs 148–150, 151, 159

networks, Bayesian
advantages 215–216
Bayfish-Bac Lieu model (Vietnam)
consultation process 209–210
variable: definition and weighting 211–213
variable: parameterization 214–215
variable: specification 213, 214
variables: network 212
water and food model 210–211
examples of mini-networks 208
principles 207–209
New Institutional Economics
application to conflict resolution 259, 261–262
case study: shrimp farming in India 262–264, 267–270
decentralization and devolution 265–267
definition and scope 260–261
non-governmental organizations (NGOs) 283–284
open-access resources 22–23
problems of enclosure 26–27
oysters 159
pesticides: as model variable 213, 214
planning see land-use planning
PLUP (participatory land-use planning) 178, 180, 182–185, 186, 188–191
pollution 6, 277
populations 277
poverty 13
in areas of salinity control 38, 40–41, 42, 56–57
and diversity 275–277
impact of change on the poor 278–282
and integrated coastal zone management 284–287
livelihood enhancement and diversification 286–290
poverty dynamics analysis 31–32, 41–45
responses to coastal poverty 282–284
and vulnerability 50
production: as model variable 214–215
rainfall: as model variable 213, 214
Ramsar Convention 166
regulation
difficulties 13
effluent 8
see also codes of conduct
Local Environment Plans (Australia) 119
replanting: mangrove forests 130, 134–135, 136, 137
reserves, extractive 160–161
resource management domains
applied to Mekong Delta, Vietnam
at broad level 196–197
conflicts over land use 195–196
at detailed level 197–202
hamlet clusters 196, 199, 200–201
definition and concept 194–195
role in planning and management process 202–204
rice
abandonment of rice fields 170
acid generation from rice fields 57–58
in areas of controlled salinity 33–34
conflict between rice farmers and shrimp producers 49
conversion of farms to shrimp farming 4, 49, 50–51, 90
environmental impact 6
decreased yield attributed to salinization 63
new cultivation strategies 73
cropping system and water management 75–76
environmental impact 82–83
experimental set-up and parameters 77–79
farmer participation 76–77
variations in water and soil salinity 79–80, 81
yields and farmers' income 80–82, 83
productivity
rice-shrimp system 41–42, 43
short-duration high-yield varieties 73, 76
characteristics 78
dry season yields 81–82
wet season yields 80, 81
Rio Earth Summit 163, 259
river basins
closure 296–297
impact of changes on coastal regions 298–299
irrigation: issues of scale 297–298
salinity
addressed by Coastal Embankment Project (Bangladesh) 73–74
average monthly salinity, Kazibachha River, Bangladesh 76, 80
cropped vs. fallow lands 80
effect of new rice cultivation strategies 82–83
groundwater salinity and water management strategies 79
impact studies of salinity control see under Vietnam
increased by lack of rain 170
monitoring of water and soil 77–78
salinization due to shrimp farms 6, 7, 55
blamed for poor crop yields 63–65
Saloum National Park (Senegal) 171
Senegal 170, 171
sesame 74–75
ship bore worm (turu) 159
shrimp farming
application of New Institutional Economics 262–264, 267–270
concerns caused by rapid expansion 2, 127
conflict with rice farmers 49
a critical land-use issue 12
culture systems 2–3
gher system (Vietnam) 61–62
integrated shrimp-mangrove systems 9
intensive systems 88–89
low-salinity systems 89–91
rice-shrimp systems 41–42, 43
semi-intensive culture 87–88
thammachat (‘natural’ shrimp farms, Thailand) 87
shrimp farming continued

- economic importance 17
- farm characteristics 56
- in freshwater areas 91–92
- government subsidies 128
- growth rates 1970–2000 2
- impact of upstream users 6
- impact on developing countries 140
- investment patterns 127–128

Mahakam Delta study of mariculture vs. fisheries see under Indonesia

- major producers 3
- major source of income and employment 2
- acid pollution 57
- field crops and vegetation 63–67
- livestock and poultry 67–68
- mangrove destruction 3–4, 126–128, 130, 166
- negative impacts: humans 5, 24–26, 56–57, 68–69, 242

Ecuador study see under Ecuador: shrimp farming

- perceptions of local communities 146
- productivity 20–21
- rice–shrimp system 41–42, 43
- regulations and codes of practice 8–9, 94
- rice farm conversion 4, 6, 49, 50–51, 90
- sources of water pollution 6
- sustainability 55–57, 89, 92–95

Sierra Leone 170

silvo-fishery systems 9

‘snowball sampling’ 19

social capital 266–267

soils, acid sulphate see acid sulphate soils

Sri Lanka 10

stewardship, coastal 109, 150–151

strategic environmental assessment 11

sugarcane
- attitudes of cane farmers 115–116
- best practice guidelines 119
- effects of industry on fish 112
- land management changes 118–119

survives on shallow groundwater 117

sulphides: in water and soil see acid sulphate soils

sustainability
- essential requirements 49–50
- key challenges in coastal zone management 108
- of livelihoods 287–290
- shrimp production 55–57, 89, 92–95
- problems 127

strategies
- aquaculture planning 92
- social organization 93–95
- water supply infrastructure 92–93

Sustainable Livelihood Framework 31

tambak system 9, 222–223, 224

production trends 225–227

Taura syndrome virus 92

technology: changes 278

Thailand

- conversion from rice to shrimp farming 4, 6
- integrated coastal zone management 10
- mangrove dependency case studies
  - conclusions and policy implications 135–138
  - conservation and replanting 130, 134–135, 136, 137
  - labour allocation: impact of mangrove loss 133–134
  - labour allocation and employment 130–133
  - mangrove degradation due to forest concessions 129
  - mangrove loss due to shrimp farming 126–128, 130
  - methodology 128
  - study villages 128–129

salinization 6

shrimp farming
- codes of conduct 94
- in freshwater areas 91–92
- government subsidies 128
- initiatives to improve sustainability 89
- investment patterns 127–128
- lack of sustainability 127
- production levels 88, 90
- strategies for sustainability 92–95
- traditional systems: 1930–1971 87
- water supply conflicts 93

thammachaat ('natural' shrimp farms, Thailand) 87

tin: mining concessions 128

tourism 173

Traditional Ecological Knowledge 172

training see education and training

turu 159

Tweed River Advisory Committee (Australia) 112


Vietnam

- changes in livelihood structure 21–23, 25
- conflict resolution using resource management domains see under resource management domains
- decision support system based on Bayesian networks see under networks, Bayesian
doi moi (renovation) policy 30
economic significance of mangrove products 18–19
economic importance 17
ethnic minorities 23
land owners 22, 23
land use and property systems 18
land-use planning in Mekong Delta see under land-use planning
land-use planning
landless households 23
map of case study sites 19
Mekong Delta land-use planning study
  background 177–178
  study area 178–180
open-access resources 22–23, 26–27
salinity control: impact studies
  acid sulphate soils 51–52, 57–58
  capital endowment 34–35, 36
  changes in saline intrusion with time 50
  conclusions 45–46
  conflict between shrimp producers and rice farmers 49
  effects on fish and fisheries 54, 57, 59
  environmental management strategies 54
  household incomes 38, 39, 40, 44, 45
  livelihood strategies 35–38, 54–55
  methodology 32, 33, 34, 52–54
  poverty 38, 40–41, 42, 44, 56–57
  production system changes 32–34, 49, 50–51
  short-term impact 54–55
  yields and productivity 41–42
shrimp farming
  conversion from rice cultivation 4, 49, 50–51
shrimp farming
conversion from rice cultivation 4, 49, 50–51
social impact of ecosystem changes 7
vulnerability 50

water
  key trends 296
  on-farm storage of surface water 75, 77, 83
  pollution by shrimp farms 6
  quality of drain-water from acid sulphate soils 102–103, 104
  requirements for food production 294–295
  supply infrastructure 92–93
  see also river basins
wetlands: loss through drainage 295–296

zoning 10–11, 12–13, 92
  based on land suitability 242–243
  FAO agro-ecological zones (AEZ) 194
  indicative land zones in Bangladesh 246, 247
  programmes and policies 243–245
  use of resource management domains see resource management domains