

Contents

List of illustrations
Supplemental material
List of abbreviations

PART 1 **Context**

1 What is sustainability?

Defining sustainability 3
Systems thinking 4
Resilience 5
Complex adaptive systems 6
Tipping points 7
Living in the Anthropocene 8

2 A brief history of sustainability

Recent history: the last 200 years 13
Early conservation 14
Transformation from conservation to ecology 15
The beginnings of the environmental movement 16
Political responses 18
Environmental justice 21
Environmental ethics 22
Expanding to a global scale 25
Modern trends 28
Into the Anthropocene 30

The human sphere 4
Human impact 27
Economics 64
Fragile states 73
Sustainable development 76
Governance 77
The commons 79

1
PART 2
3

13

6

12

134

3 The biosphere

34

Why study living systems? 34

Energy and matter 34

The four spheres 38

The biosphere 43

What is life? 47

Earth system science 51

4 The human sphere

57

Human impact 57

Economics 64

Fragile states 73

Sustainable development 76

Governance 77

The commons 79

PART 2

Issues and solutions

5 Climate

83

Is Earth warming? 86

How temperature records are compiled 88

The long view: climates through time 89

Modern climate change and greenhouse gases 90

The human factor 94

Impacts of climate change 95

United Nations Convention on Climate Change 105

Mitigation 106

Adaptation 111

Final thoughts 112

6 Water

116

Uneven distribution 117

Depletion of nonrenewable aquifers 119

Threats to human and ecosystem health 121

Consumption 123

Effects of climate change 125

Water conservation 125

Net zero water 133

Final thoughts 134

7 Ecosystems and habitat

- Populations and extinction* 137
- Drivers of ecosystem change* 139
- Conservation and restoration* 147
- Conservation* 148
- Restoration ecology* 152
- Living together: reconciliation ecology* 157
- Corridors and connectivity* 161
- Ecology in the Anthropocene* 164

8 Pollution

- Types of toxins* 169
- Pollution transport and fate* 171
- Air pollution* 172
- Soil and land pollution* 176
- Water pollution* 177
- Organic pollutants* 179
- Inorganic pollutants* 179
- Endocrine disruptors* 181
- Persistent organic pollutants* 182
- Point source and nonpoint source pollution* 182
- Radioactive pollutants* 183
- Microplastics and nanoparticles* 183
- Pollution remediation* 184
- Pollution prevention* 193

9 Energy

- Fossil fuels* 197
- Renewable energy* 204
- Energy efficiency* 220
- The energy transition* 225

10 Green buildings

- What is a green building?* 232
- The process of green building design* 233
- Passive heating and cooling concepts* 234
- Heating* 236
- Cooling* 239
- Other strategies for cooling* 241
- Ventilation* 242

Lighting with daylight 243

Building envelope 244

Construction 248

Rating systems 249

Biophilic design 253

Acoustics 254

11 Sustainable sites

Rating systems: LEED and SITES 258

Site context 260

Soil 262

Vegetation 266

Stormwater 269

Wastewater treatment 272

Issues of light and sound 277

782 Land 279

12 Livable cities

Sprawl 282

Land-use planning 284

Urban planning 285

Building community 293

Transportation 294

LEED v4.1 Cities and Communities 299

Inclusive and affordable housing 299

Cities and climate change 301

197

13 Food

Farming methods and scale 306

Human health issues 311

Planetary health issues 314

Feeding ourselves 322

231 Finding space for food in the city 328

Food policy 333

Food on public land 334

14 Products

Materials and resources 340

Toward a circular economy 342

Process design 346

Product alternatives 347

Product design 348

x Contents

- Lighting with daylight* 243
- Building envelope* 244
- Construction* 248
- Rating systems* 249
- Biophilic design* 253
- Aesthetics* 254

11 Sustainable sites

- Rating systems: LEED and SITES* 258
- Site context* 260
- Soil* 262
- Vegetation* 266
- Stormwater* 269
- Wastewater treatment* 275
- Issues of light and sound* 277
- Land* 279

12 Livable cities

- Sprawl* 282
- Land-use planning* 284
- Urban planning* 285
- Building community* 293
- Transportation* 294
- LEED v4.1 Cities and Communities* 299
- Inclusive and affordable housing* 299
- Cities and climate change* 301

13 Food

- Farming methods and scale* 306
- Human health issues* 311
- Planetary health issues* 314
- Feeding ourselves* 322
- Finding space for food in the city* 328
- Food policy* 333
- Food on public land* 334

14 Products

- Materials and resources* 340
- Toward a circular economy* 342
- Process design* 346
- Product alternatives* 347
- Product design* 348

258

282

305

340

18 Working as agents for change

- Fostering sustainable behavior* 440
- Efforts big and small* 448
- Working together* 452
- Social equity* 454
- Building community* 456
- Transition* 458

Bibliography

Index

- Soil* 262
- Vegetation* 266
- Stormwater* 269
- Wastewater treatment* 275
- Issues of light and sound* 277
- Land* 279

19 Livable cities

- sprawl* 282
- Land-use planning* 284
- Urban planning* 285
- Building community* 293
- Transportation* 294
- LEED v4.1 Cities and Communities* 299
- Inclusive and affordable housing* 300
- Cities and climate change* 301

13 Food

- Farming methods and scale* 306
- Human health issues* 311
- Planetary health issues* 314
- Feeding ourselves* 322
- Finding space for food in the city* 328
- Food policy* 333
- Food on public land* 334

14 Products

- Materials and resources* 340
- Toward a circular economy* 342
- Process design* 346
- Product alternatives* 347
- Product design* 348

328 packaging and packaging 328
328 standards 328
329 applications and labels 329
362 sustainable consumption 362

362 recycling 362

367 waste management 367

368 credits 368

370 innovation 370

371 recycling 371

379 construction & demolition waste 379

380 industrial waste 380

380 waste 380

Working as an agent for change

Working in an organization

389 organizational governance 389

391 accountability professionals at work 391

392 corporate social responsibility 392

393 accountability initiatives 393

397 planning process 397

397 vision 397

402 making the business case for sustainability 402

402 motivation 402

404 networks 404

404 measurement and reporting 404

410 measurement and reporting systems 410

420 social change 420

424 education 424

424 initiatives 424

424 place-based learning 424

426 learning by doing: Experimental learning 426

428 the learning environment 428

433 stages of development: humans as lifelong learners 433

433 education levels 433

436 Traditional Ecological Knowledge (TEK) 436

437 social change 437