
Contents

Introduction	xvii
Part 1. Strategic and Technical Aspects of Flood Prevention.	1
Chapter 1. Flood Management in France from 18th to 20th Centuries: A State Issue?	3
Denis CŒUR	
1.1. Introduction.	3
1.2. Forecast and alert: from local empiricism to regional monitoring networks	3
1.3. Managing flood events and their immediate impacts: collaboration between the State and local authorities	7
1.4. Rebuilding and prevention: a slow and uneven change in scale	8
1.5. Conclusion	11
1.6. Bibliography	12
Chapter 2. The French Flood Risk Management Model: Local Territories Facing State Omnipresency	15
Bruno LEDOUX	
2.1. Introduction: French policy on flood risk management	15
2.2. Insurance component of the 1982 legislation	16
2.3. Prevention component of the 1982 legislation	16
2.4. PPR tool and characteristics of territories	18
2.5. Dikes and urbanization beyond flood defenses	18
2.6. From policy focused on the use of PPRs to more integrated management of flood risk	20
2.7. 10-year plan: restoration and maintenance of rivers (1994–2002).	21
2.8. Flood Prevention Action Programs	21

2.9. The implementation of the Flood Directive: renewing risk prevention policy, or a big mess?	24
2.10. A new skill for local government: management of aquatic environments and floods (GEMAPI)	26
2.11. Conclusion	28
2.12. Bibliography	29
Chapter 3. Management and Safety of Flood Defense Systems	31
Rémy TOURMENT, Bruno BEULLAC and Daniel POULAIN	
3.1. Limitations of levees	31
3.1.1. Natural events exceeding the protection level	32
3.1.2. Flood defense system failures	33
3.1.3. Flood-related consequences involving levees	33
3.1.4. Effective protection of flood defense systems	34
3.2. Failure modes	35
3.2.1. Levee system failures	35
3.2.2. Loads on flood defense systems	37
3.2.3. Main elementary deterioration mechanisms	37
3.2.4. Feedback, failure scenarios	39
3.3. Levee assessment and system risk analysis	39
3.3.1. Characteristics of risk analysis applied to flood defense systems.	40
3.3.2. Probability of failure of the flood defense system.	41
3.3.3. Modeling breaches and floods	42
3.3.4. Consequence estimation.	42
3.3.5. Estimation and evaluation of risk, and risk reduction measures (to support decision-making).	42
3.4. Conclusion	43
3.5. Bibliography	44
Chapter 4. Coping Strategies in Dike Protected Areas	45
Damien SERRE, Johnny DOUVINET, Charlotte HEINZLEF and Eric DANIEL-LACOMBE	
4.1. Introduction.	45
4.2. Challenges concerning diked up areas	46
4.2.1. Historically sought-after areas	46
4.2.2. Fragile and flood-prone areas.	47
4.3. What strategies should be adopted?	47
4.4. Option 1: focusing on dikes	49
4.5. Option 2: treating dikes as simple tools	51
4.6. Option 3: combining flood defense systems and protected assets	54

4.7. Conclusion	56
4.8. Bibliography	57
Chapter 5. Floods and Land Rights: From Risk Prevention Plans to Administrative Accountability and Penal Liability	59
Helga SCARWELL	
5.1. From emergency relief to flood risk prevention	60
5.1.1. Risk management rationale developed from the perspective of emergency and safety	60
5.1.2. A comprehensive risk management policy based on the progressive integration of floods in urban planning laws	61
5.2. Legislative overhaul of the flood risk management framework based on effective control of urban planning: the primary line of defense against flood risk.	63
5.2.1. Legal integration of flood risk via the PPR and risk prevention principle	64
5.2.2. Prevention via planning and public easements in flood-prone areas.	65
5.2.3. Flood risk prevention outside of floodplains	67
5.3. Land rights versus flood risk.	69
5.3.1. Amicable acquisition and expropriation of severely exposed assets	70
5.3.2. Other tools available for the management of land exposed to risk	70
5.4. Collective responsibility: second line of defense against flood risk. . .	71
5.4.1. Restoring accountability.	72
5.4.2. The legal system plays catch up after a disaster pending feedback from citizens	74
5.5. Conclusion	75
5.6. Bibliography	76
Chapter 6. How Cost-Effective is Reducing the Vulnerability of Housing in Response to Flood Risk?	79
Nicolas BAUDUCEAU and Julien JADOT	
6.1. A policy that struggles to anchor itself within the territory	79
6.2. Two possible technical strategies exist in terms of reducing vulnerability of existing housing	80
6.3. Less cost-effective than first thought.	82
6.3.1. Clarifications concerning the methodology	82
6.3.2. Cost-effectiveness limited to certain exposure conditions and a small number of measures	83

6.3.3. Assessment	87
6.4. Conclusion: rethinking current policy on vulnerability reduction of housing	88
6.5. Bibliography	89
Part 2. Territories and Individuals at the Heart of Prevention	91
Chapter 7. Does the Watershed Represent a Key Area within Flood Risk Knowledge and Management?	93
Régis THEPOT	
7.1. Introduction.	93
7.1.1. Actors within the flood risk management chain	93
7.1.2. Nature and severity of flood risk	94
7.1.3. Local flood risk management strategies: resistance or resilience?	94
7.2. The watershed: institutionally referenced for knowledge and management of flood risk and for the implementation of structural measures	94
7.3. Flooded areas: points of reference for residents	95
7.4. Complementarity between knowledge and management of flood risk across flooded areas and risk catchment areas is required	96
7.5. Conclusion	100
Chapter 8. Sustainable Land Use Planning in Areas Exposed to Flooding: Some International Experiences	103
Anna RIBAS PALOM, David SAURÍ PUJOL and Jorge OLCINA CANTOS	
8.1. Introduction.	103
8.2. How to regulate land uses in front of the flood hazard?	104
8.2.1. The “escalator effect” of hydraulic works	104
8.2.2. Exposure and vulnerability reduction: flood mapping and land use regulation of flood prone areas	105
8.2.3. Living with risk: more room for floods	107
8.3. International examples	108
8.3.1. The Netherlands: from room behind dykes to room for rivers	108
8.3.2. The case of the USA	109
8.3.3. The case of Spain	112
8.4. Conclusion	115
8.5. Bibliography	116

Chapter 9. Societal Choices in Flood Risk Management, from Individual Responsibility to National Policy	119
Robert SLOMP and Wout DE VRIES	
9.1. Introduction.	119
9.1.1. Individual responsibility versus national policy choices	120
9.2. The impact of national, regional and local policy	122
9.2.1. Instruments and tools.	122
9.2.2. Policy consequences	124
9.2.3. Very low probabilities, very large consequences	125
9.2.4. Evaluating flood risk management over long periods of time	129
9.3. Societal choices	130
9.3.1. The influence of past flood events	130
9.3.2. Organizational and financial choices	132
9.3.3. Choices that increase the flood risk	133
9.4. Individual responsibility	134
9.5. National choices	134
9.6. Conclusion	135
9.7. Bibliography	136
Chapter 10. “Sustainable Flood Memories”: Developing Concept, Process and Practice in Flood Risk Management	141
Lindsey MCEWEN and Andrew HOLMES	
10.1. Introduction	141
10.2. What is the concept of Sustainable Flood Memories?	143
10.3. What are the processes of Sustainable Flood Memory?	145
10.4. How can the practice of Sustainable Flood Memory be developed?	151
10.5. Conclusion	153
10.6. Acknowledgements	153
10.7. Bibliography	153
Chapter 11. Integrating Anthropocentric Approaches into Flood Risk Management	157
Béatrice GISCLARD, Clément LAVERDET and Karine WEISS	
11.1. Adapting perspectives to local characteristics.	158
11.2. Developing information and communication	160
11.2.1. Engaging citizens	161
11.2.2. Adapting crisis communication to current tools	162
11.2.3. Audience analysis as a means to improve crisis communication	164
11.3. Conclusion	166
11.4. Bibliography	167

Part 3. Anticipating and Managing Flood Events	171
Chapter 12. Characteristics of Flood Events	173
Freddy VINET	
12.1. The nature of flood events as a crisis	173
12.2. Flood characteristics	173
12.2.1. A “profane” risk	173
12.2.2. Foreseeable crisis	174
12.2.3. Importance of the post-crisis period	174
12.3. Mental representations: long-term trends at the root of the crisis	175
12.4. Techniques and behavior	176
12.5. Conclusion	176
12.6. Bibliography	176
Chapter 13. Effectiveness of Institutional Alert Tools in Flood Forecasting in France	179
Johnny DOUVINET and Bruno JANET	
13.1. Introduction	179
13.2. Flood alerts and warnings: two different significations	180
13.3. Notification procedure: a process heavily managed by the State.	182
13.3.1. Role and responsibilities of competent authorities.	182
13.3.2. Form and content of notifications	183
13.3.3. Structures designed to warn inhabitants	183
13.4. The effectiveness of institutional alert tools: from theory to reality	184
13.4.1. The National Alert Network (RNA in French)	184
13.4.2. Mass diffusive alerting tools (SAM in French).	186
13.4.3. Local early notification tools (SDAL in French).	187
13.5. Limitations and pathways for expected improvement	190
13.5.1. Current pitfalls of institutional notifications	190
13.5.2. Progress in course	190
13.6. Conclusion	191
13.7. Bibliography	192
Chapter 14. From Public Involvement to Citizen-based Initiatives: How Can Inhabitants Get Organized to Face Floods?	195
Béatrice GISCLARD, Johnny DOUVINET, Gilles MARTIN and Arnaud DEMONTIS	
14.1. Introduction	195
14.2. The citizen as an actor: an overlooked reality in public policy	196
14.2.1. Underestimated political and social dimensions	196

14.2.2. Underestimated cognitive dimensions	197
14.3. A great number of citizen-led initiatives exist, however.	198
14.3.1. Wide variety of media	198
14.3.2. A manner for institutions to reconcile with individuals.	199
14.3.3. Citizen-based initiatives supported by digital tools	201
14.4. Which avenues encourage citizen-based initiatives?	203
14.4.1. Reintroduce floods into daily life.	203
14.4.2. Paving the way for new approaches through social innovation	204
14.5. Conclusion	205
14.6. Bibliography	205

Chapter 15. Crowdsourcing and Crisis-Mapping in the Event of Floods: Tools and Challenges 209

Johnny DOUVINET, Jules KOUADIO, Emmanuel BONNET and Jérôme GENSEL

15.1. Introduction	209
15.2. What benefits can we expect from these tools?	210
15.2.1. Advantages of crowdsourcing, a new form of data collection.	210
15.2.2. Advantages of crisis mapping, a process as close to real-time as possible	211
15.3. How and why did these tools emerge?	212
15.3.1. New opportunities due to geomatic advances	212
15.3.2. New opportunities due to advances in mobile technologies	212
15.3.3. New opportunities enhanced by Digital Social Networks (DSNs).	213
15.4. Future challenges and potential breakthroughs	215
15.4.1. Further ensuring the quality of information collected.	215
15.4.2. Better understanding the practice of contributors	215
15.4.3. Improving systemic approaches with common objectives	216
15.4.4. Bringing contributors closer to institutions	217
15.5. Weaknesses and limitations of tools	218
15.6. Conclusion	220
15.7. Bibliography	220

Chapter 16. Flood Crisis Management: The Operational Perspective 225

Luc CORACK, Sébastien DESCHAMPS and Freddy VINET

16.1. Introduction	225
16.2. Flooding: direct and indirect consequences for SDIS	226
16.3. Local risk knowledge	226

16.4. The development of crisis management regulations in France	227
16.5. SDIS in the national public protection system.	228
16.6. Operational flood management: adapting to all circumstances	229
16.7. Assessing and monitoring the risk situation	230
16.7.1. Vigilance and forecasting of flood risk	230
16.7.2. Planning measures	231
16.7.3. Social networks in Emergency Management (MSGU)	232
16.7.4. Organization of communication	232
16.7.5. Resorting to extra-departmental resources	233
16.8. Operational implementation of fire and rescue services	234
16.8.1. Chronological overview of operational activities	234
16.8.2. The issue of evacuation	236
16.9. Conclusion	238
16.10. Acronyms	239

Chapter 17. Local Crisis Management – The Communal Safety Plan: Challenges and Obstacles to Operationality 241

Eric PIATYSZEK, Pierre-Alain AYRAL and Mathilde GRALEPOIS

17.1. Introduction	241
17.2. General information on local emergency management abroad, and by means of the Communal Safety Plan in France	242
17.2.1. The international situation	242
17.2.2. Context and the French judicial framework: the emergence of the PCS mechanism.	243
17.2.3. The content of the PCS in a few words	244
17.2.4. Current state of affairs: a late but decisive catch-up.	244
17.3. The problem of PCS operationality.. . . .	245
17.3.1. PCS content influences operationality	245
17.3.2. The participatory and interdisciplinary dimensions are often neglected when the PCS is drafted.	246
17.3.3. Warning and activation of the PCS: a tricky coordination	247
17.4. PCS implementation put to the test: Villandry during the floods of May 2016	251
17.4.1. Villandry: situation and hydrological context	251
17.4.2. A quick overview of the events of May/June 2016	252
17.4.3. Villandry in the face of the events of May/June 2016.	253
17.5. Conclusion	255
17.6. Bibliography	255

Chapter 18. Anticipating or Coping: Behaviors in the Face of Flash Floods	259
Isabelle RUIN, Céline LUTOFF and Saif SHABOU	
18.1. Introduction	259
18.2. Observing behaviors in a flash flood situation: a methodological challenge	260
18.2.1. Surveys of intentions	261
18.2.2. Feedback after flooding	262
18.2.3. Analysis of fatal circumstances	265
18.3. High-risk behavior or bad luck?	266
18.4. Scrutinizing the interactions between physical and social dynamics	270
18.5. Conclusion	272
18.6. Bibliography	272
Part 4. Post-disaster Recovery and Adaptation	277
Chapter 19. Disaster Memories and Population Resilience	279
Serge TISSERON, Fabien AGNERAY and Léna POULAIN	
19.1. Flooding, a historically collective concern.	279
19.1.1. Flooding in founding myths	280
19.1.2. Flooding in the history of cultures	281
19.2. Trauma and its consequences	282
19.2.1. Diverse memories	282
19.2.2. “Being” flooded: from the house to the self	283
19.2.3. Being flooded: a personal matter	284
19.2.4. After the trauma: the risk of post-traumatic stress	286
19.2.5. Narrative memory and mental reconstruction	287
19.3. Resiliences	289
19.3.1. The period of individual resiliences	289
19.3.2. Societal resilience and its four successive periods.	291
19.3.3. A new culture	293
19.4. Conclusion	294
19.5. Bibliography	294
Chapter 20. Economic Resilience, Total Loss Control and Risk Transfer	297
Roland NUSSBAUM with contributions by Reimund SCHWARZE and Swenja SURMINSKI	
20.1. What is the optimum for overall risk cost control?	298
20.1.1. What does “overall risk cost” comprise of?	298

20.1.2. How should overall risk cost be managed?	299
20.1.3. From transfer to risk sharing.	301
20.2. Role of insurance in funding damage repair and supporting economic resilience'	302
20.2.1. Instruments for funding damage repair	302
20.2.2. The benefits of flood insurance	302
20.2.3. Insurance penetration, an indicator of economic resilience capacity	305
20.3. Comparative analysis of integrated risk transfer systems	306
20.3.1. The 5 typical models	306
20.3.2. Comparative analyses	309
20.4. Public/private partnerships for integrated flood risk management . . .	310
20.4.1. Examples of flood insurance partnerships.	311
20.4.2. Involving other stakeholders	315
20.5. Conclusion and perspectives	316
20.6. Bibliography	317
Chapter 21. Economic Assessment of Flood Prevention Projects.	321
Katrin ERDLENBRUCH and Frédéric GRELOT	
21.1. The introduction of economic assessment in France	322
21.1.1. The Floods Directive and its application on the national level. . .	322
21.1.2. Flood prevention action programs	323
21.2. Economic assessment in France	325
21.2.1. Cost-benefit analysis	326
21.2.2. Taking non-monetary indicators into account	330
21.2.3. Labeling and assessment in figures.	331
21.3. Limitations and possible evolutions of economic assessment in France	332
21.4. Conclusion and perspectives	333
21.5. Bibliography	334
Chapter 22. Flood Debris Management	337
Charlotte NITHART	
22.1. Introduction	337
22.2. Debris proliferates	337
22.3. Typology, volume, sorting and processing of flood debris	338
22.3.1. Typology	338
22.3.2. Volume	339
22.3.3. Sorting and processing	339
22.4. Health and environmental issues	340
22.5. Flood debris in planning	341

22.6. Feedback after Katrina (2005)	343
22.7. Feedback after Xynthia (2010).	344
22.8. Conclusion	347
22.9. Bibliography	347
Chapter 23. Post-Flood Recovery: An Opportunity for Disaster Risk Reduction?	349
Annabelle MOATTY	
23.1. Introduction	349
23.2. Characterizing the process through analysis of its time frames.	350
23.3. Restructuring governance and rebuilding territories	353
23.4. Developing the Build Back Better opportunity in the recovery process: anticipating ethical and preventive adaptations	356
23.5. Conclusion	359
23.6. Bibliography	361
Chapter 24. Towards an Urban Design Adapted to Flood Risk?	365
Sylvain RODE and Mathilde GRALEPOIS	
24.1. Resilient building in floodplains: architectural and urban forms	366
24.1.1. An urban design of elevation	366
24.1.2. Urban forms designed to allow flood flow-through	367
24.1.3. Urban design highlighting the sensitive presence of water.	368
24.2. Resilient building in floodplains: what are the specific features in relation to a conventional development project?	370
24.2.1. Risk, now at the heart of urban design?	370
24.2.2. Urban design in floodplains: an activity marked by the presence of the State?	371
24.3. Resilient urban design into the test	373
24.3.1. Resilience put to the test of urbanity.	373
24.3.2. Urban design put to the test of flooding	375
24.4. Conclusion	378
24.5. Bibliography	378
Conclusion	381
List of Authors	389
Index	393