Natural Hazards and Public Management

Governing Climate Adaptation

Edited by Wolfgang Seibel · Andrew Butt
Michael Buxton · Jana Blahak

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Preface and Acknowledgments

This book presents the results of a collaboration between European, South African, and Australian researchers who have looked at the main challenges faced by authorities in dealing with the consequences of climate change, particularly natural hazards such as wildfires and floods. The technique of analysis is not abstract or deductive but focuses on exemplary cases of undeniable failure of relevant public policies in Argentina, Australia, Greece, South Africa, and the USA. While the selection of case studies is biased by the availability and accessibility of primary sources, we believe that the cases themselves are instructive in their own right, particularly as they challenge stereotypical assumptions about risk exposure and vulnerability to the impacts of climate change. What these cases demonstrate above all is the relativity of overall resilience and, conversely, the vulnerability of communities and entire countries that, in principle, have sufficient scientific knowledge and administrative capacity to protect their citizens effectively against natural hazards.

The key factor always is land use. While the general debate on the consequences of climate change tends to focus on the exposure of entire countries or global regions to particular risks of flooding or devastating wildfires, the cases analysed in this book focus on the failures of public policy, whose main characteristic is the missed opportunity to change land use and infrastructure policies. As a result of climate change, previously tolerated practices are increasingly becoming an unacceptable risk factor. By focusing on public policy and administrative management, the case

studies also allow for a realistic assessment of policy change and learning. While it is undeniable that the brunt of the negative impacts of climate change will hit geographical regions and social groups that are already disadvantaged, there are counterintuitive patterns of resilience and vulnerability as a result of vested stakeholder interests. For example, the strength of community resilience can be both an asset and a liability when it comes to natural hazard risk mitigation. Similarly, government at all levels can forge productive or counter-productive alliances within stakeholder networks. While developers and the construction industry are the drivers of extensive and intensive land use, insurance companies are, by definition, the natural allies when it comes to risk mitigation. Ultimately, what is needed is a sober assessment of the risks associated with land use practices, and a recognition of productive and counter-productive alliances in forging risk mitigation strategies.

The idea and the production of this book would have been unthinkable without the support of various institutions and individuals. Jana Blahak initiated the cooperation of herself and Wolfgang Seibel with Michael Buxton, Andrew Butt, and Dave Mercer of the Royal Melbourne Institute of Technology. This happened in the course of the long-term research project "Black Swans in Public Administration. Rare Organizational Failure with Severe Consequences" financed by the German Research Association (DFG, project no. 329566223) in the framework of the DFG Reinhart Koselleck program. Wolfgang Seibel wishes to thank the Stellenbosch Institute for Advanced Study (STIAS) for the hospitality in support of the collaboration with Robyn Pharoah of the Research Alliance for Disaster and Risk Reduction (RADAR) at Stellenbosch University in December 2022. He is also indebted to the Utrecht School of Governance of Utrecht University where Chap. 4 of this volume was drafted during his stay as a Visiting Professor in May and June 2023 and to Kimiko Barrett, Megan Lawson, and Kristin Smith of Headwaters Economics for invaluable advice and hints. Aditi Tiwari and Christine Eckardt have been helpful in the search for image material, verifying copyright statuses and of the formal editing of large parts of the manuscript. We are particularly grateful to the anonymous referees and Palgrave Macmillan's responsible editor,

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Konstanz, Melbourne and Oslo
January 2026

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Contents

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Abbreviations

AdA	Autoridad del Agua (Argentina)
AVI	Affluence-Vulnerability Interface
BBB	Building Back Better
BPA	Bushfire Protection Area
BAL	Bushfire Attack Level
BMO	Bushfire Management Overlay
CAISO	California Independent System Operator Corporation
CDTFA	California Department of Tax and Fee Administration
CFPR	Camp Fire Public Report
CISAUA	Instituto de Geomorfología y Suelos de la Facultad de Ciencias Natural y Museo, Universidad de La Plata (Argentina)
CPUC	California Public Utilities Commission
COP	Conferences of the Parties
COU	Código de Ordenamiento Urbano (Argentina)
COUT	Consejo de Ordenamiento Urbano y Territorial (Argentina)
CRC	Cooperative Research Centre (Australia)
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
DEADP	Department of Environmental Affairs and Development Planning (South Africa)
DEECA	Department of Energy, Environment & Climate Action (State of Victoria, Australia)
DELWP	Department of Environment, Land, Water and Planning (State of Victoria, Australia)
DMA	Disaster Management Act (South Africa)
DMH	Dirección Municipal de Hidráulica (Argentina)
DMP	Dirección Municipal de Planificación (Argentina)

DiPSOH	Dirección Provincial de Saneamiento y Obras Hidráulicas (Argentina)
DRG	Disaster Recovery Grant (South Africa)
DRR	Disaster Risk Reduction
DWS	Department of Water and Sanitation
ETPM	Electric Transmission Preventive Maintenance Manual
EU ETS	EU Emissions Trading System
FEMA	Federal Emergency Management Agency
FBSA	Fire Brigade Services Act (South Africa)
FDI	Fire Danger Index
FFDI	McArthur Forest Fire Danger Index
FPAs	Fire Protection Associations
GFDRR	Global Facility for Disaster Reduction and Recovery
GRRI	Garden Route Reconstruction Initiative (South Africa)
GFMC	Global Fire Monitoring Centre (University of Freiburg, Germany)
HIZ	Home Ignition Zone
IBHS	Insurance Institute for Business and Home Safety
IDNDR	International Decade for Natural Disaster Reduction
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
NFPA	National Fire Protection Association (USA)
NDMC	National Disaster Management Centre (South Africa)
NDMF	National Disaster Management Framework (South Africa)
NETTRA	Notification, Evacuation, Traffic, and Temporary Refuge Areas
NIST	National Institute of Standards and Technology
NSW	New South Wales (Australia)
NWF	National Wildlife Federation (USA)
NVFFA	National Veld and Forest Fire Act (South Africa)
NWCG	National Wildfire Coordinating Group
OECD	Organisation for Economic Co-operation and Development
PG&E	Pacific Gas and Electric Company
PDRG	Provincial Disaster Response Grant (South Africa)
QCR	Qualified Company Representative
RIBA	Risk-Informed Budget Allocation System
SFDRR	Sendai Framework for Disaster Risk Reduction (United Nations)
SDG	Sustainable Development Goal (United Nations)
SPP	Statement of Planning Policy
TAM	Transmission Asset Management
TRA	Temporary Refuge Areas
UNFCCC	United Nations Framework Convention on Climate Change
IPCC	United Nations Intergovernmental Panel on Climate Change
UGB	Urban Growth Boundary

UNEP	United Nations Environment Programme
UYVDRA	Upper Yarra Valley and Dandenong Ranges Authority (Australia)
VCEC	Victorian Competition and Efficiency Commission (Australia)
VHFHSZ	Very High Fire Hazard Severity Zone
WCDMC	Western Cape Disaster Management Centre (South Africa)
WMO	Wildfire Management Overlay
WRDI	Worst Reasonable Direct Impact
WUI	Wildland Urban Interface

List of Figures

List of Illustrations

List of Tables

CHAPTER 1

Introduction: Natural Hazards and Government Response between Stakeholder Pluralism and the Public Interest

Andrew Butt

In an era of global media access, and of climate change, the prevalence of disaster management and response as pervasive processes of public politics appears to be increasing, or at least of increasing note in the media and the public mind. This in turn has raised levels of political concern for addressing risk and hazard, and the public interest in resolving the impacts of disasters (whether perceived publicly and politically as 'natural' or otherwise) and improving community response and resilience. Crucially, in many places these concerns operate at the intersection of population growth, land use transition, community vulnerability and climate change. Current concerns at the likely limits to climate change adaptation efforts (IPCC, 2022) offer a focus on how effective the removal of risk and removal from hazard can be where the changing profile of this requires significant transformation politically, culturally and materially.

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Of course, disaster preparedness, management and response have long histories. After all, dealing with floods and fires is deeply embedded in common-sense practices to protect human habitats, through modern framings and as indigenous knowledge systems that include "the understandings, skills and philosophies developed by societies with a long history of interaction with their natural surroundings" (IPCC, 2022, Glossary, p. 125). This reflects the diversity of "interpretations of calamity" by Hewitt in 1983, and in the classic account on *The Culture of Fire on Earth* by Pyne in 1995. Yet the actual vulnerability of human habitats remains a matter of public risk management in the very sense of "continuous improvement in disaster preparedness, prevention and protection, response and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life and sustainable development" (IPCC, 2022, Glossary, p. 128). This can be seen particularly through institutional structures and reforms, in regulatory systems and within an increasing risk orientation in models of community preparedness and associated public discourses.

There remains persistence in many public policy and community approaches, however, that do not meaningfully reduce risk and impact in the long term, including for vulnerable locations and communities. Contrary to what is emphasised in prominent contributions to the relevant literature (e.g., Blaikie et al., 1994), such deficits do not result specifically from inequalities in access to resources and power. Instead, deliberate policy decisions, land use planning and human settlement policy decisions, in particular, can expose more people to more and increasingly risky situations.

Tensions arising in relation to the politics of place, or through associated competing policy priorities, offer examples of where evidence and assessment of risk and impact to natural hazards alone do not determine public reasoning or policy. Despite increased access to knowledge and evidence, albeit it within complex systems such as the impacts of climate change on the risk profile of cities and regions, other priorities of public policy, or indeed failure of policy implementation, prevent an adequate pathway from knowledge to policy (and of course to its effective implementation). Of course, such policy decisions occur within a context where risk and disaster preparedness are situated among a range of other public and private interest objectives, for example, the pressures of population growth, the dynamics of housing markets and the viability of public infrastructure, among others. However, disaster preparedness is necessarily

about understanding this complexity, recognising the priority that a risk profile demands and recognising that risk and impact are dynamic, especially under climate change.

1.1 Peri-Urban Regions and the Wildland-Urban Interface (WUI)

Globally, the peri-urban regions of major cities provide a hot spot for high-impact disasters and population exposure to them. Population growth, land use change and friction of the intersection between urban and rural land use and management, establishing community life for new residents and resource or economic transitions each create circumstances where risk and importantly the significance of impact and the varied resilience and capacity of community are considerable challenges that we argue are exposed within peri-urban areas. The often unclear and competing public policy objectives and priorities in these locations in turn result in policy uncertainty and failure of short- and long-term objectives as these are places where urbanisation processes, resource management priorities, and natural systems visibly intersect.

In particular (but not exclusively), those peri-urban regions that exhibit a wildland-urban interface (WUI) can be characterised by communities and landscapes that are often severely prone to high-impact disasters, and where impact is amplified by population and settlement trends that see more people, property and assets in these locations. Additionally, population growth and community transition reduce the resilience and apparent social capital that is often ascribed to longer-standing, cohesive rural communities when compared with dynamic urbanising places. Wildfire and flood are two such examples of peri-urban disaster explored in this book. They each exhibit complexity, and this complex risk demands consideration of the basis of knowledge and evidence, of definitions and of assumptions about priorities and action (Essen et al., 2021). Such complexity is evident in peri-urban areas where categories of place, as either urban or rural locations, as public or private land, and whether as 'wild' or 'ordered' places, are blurred both within policy and in the public mind, and they are very often fluid categorisations anyway. Consequently, the success (or failure) of policy in reducing risk and managing disaster is bound into broader processes of socio-environmental change that operate at varied scales, and through pathways that require the mobilisation of multiple actors and institutions, each with varied authority and legitimacy that have particular

characteristics in peri-urban regions. The sense of a common vision for cultural and environmental futures in peri-urban locations is often bounded, as notions of place and place-identity are often contested within these communities, and between community and government (von der Dunk et al., 2011; Ruoso & Plant, 2018).

Through a series of case studies, this book addresses how public policy-makers and public administration officials respond to flood and fire as natural hazards, and the management of these in the context of global climate change, particularly at the local level in peri-urban areas that are also undergoing change through real or potential processes of urban expansion and population growth. With diverse examples it demonstrates how changing patterns of natural hazards may collide with established patterns and practices of spatial planning, the perceptions and conduct of local communities and how alternative strategies could be operationalised through policy.

This volume is framed with an awareness of the range of approaches taken to understanding and addressing risk and hazard through framings including disaster risk reduction, climate change adaptation and development research community (Birkmann & McMillan, 2020), and it seeks to reflect the common ground being developed between each of these research and practice communities in recent years (see, e.g., in the assessment reports of Intergovernmental Panel on Climate Change). One point of mutual agreement that is emerging is the importance of sufficient governance and capacity in government and community to address vulnerability (IPCC, 2019, p. 27). Compared to climate change mitigation, public policy and the enforcement of regulatory approaches aimed at immediate protection against natural hazards have often remained a secondary, or delayed, concern of both public and scholarly attention (see, e.g., Deslatte et al., 2023). This is despite evidence of climate change also affecting, inter alia, land degradation processes which make the occurrence, intensity and frequency of wildfires and floods less predictable, challenging existing models for protection (IPCC, 2019, p. 53).

This book's message is that—when it comes to the management of natural hazards in peri-urban regions, whether in the context of vulnerability reduction, risk management or climate change adaptation—effective prevention requires accurate knowledge, appropriate policy settings and the mobilisation of administrative skill along with the will for the transformation of local inaction or resistance into stakeholder support for the necessary measures for the protection of human safety.

This introduction seeks to preface the series of case studies that are described in subsequent chapters by extending the traditional concept of risk as the union of a set of possible consequences and their consequent probabilities of occurrence—each over a particular time frame—to also include the consideration of uncertainty and its effects on policy understandings and the achievement of policy objectives. Additionally, the case studies seek to elucidate the changing prominence of risk framing for public policy and disaster management, and the analysis of public policy failure in the face of evident risk and hazard. In particular, it shows how the sudden, irreversible non-linear impacts from climate change, species loss and population expansion are challenging accepted settlement patterns and leading to counterproductive spatial planning policies, particularly in peri-urban areas where multiple land use objectives often co-exist in both policy and the public mind.

The cases point to inherent institutional weakness of governmental agencies in the face of urbanisation priorities. Spatial planning, urban development and protection against natural hazards and their potential consequences are often a matter of prioritising long-term objectives over short-term consensus building and concessions to local stakeholders. As the case studies of this volume reveal, the necessary robustness of public agencies facing the pressure of partial interests cannot be taken for granted. While covering a range of political and socio-economic contexts, the case studies reveal inadequacy of public policy and administration to deal with natural hazard and risk under peri-urbanisation processes, reflecting on how more reflexive and responsive policy processes may be included.

1.2 Policy Approaches: Evidence, Legitimacy and Effectiveness

Public policy approaches to disaster risk and impact often focus on risk awareness, knowledge transfer and the behaviours of communities and regulators, and this in turn inform approaches to preparedness, responses and recovery. Increasingly, understandings of 'risk' in natural hazards have looked beyond the event, and considered issues of vulnerability and exposure to establish the risk—for example, in Crichton's (2007) risk triangle. This establishes the evident interplay between natural events (hazards) and socio-cultural or political (vulnerability) and spatial (exposure) settings, and that each of these is subject to change and to policy intervention.

The tensions between these are evidently interactions between society and the environment, not merely the result of the 'naturalness' of disasters (Wisner et al., 2004) and in turn they are dependent on the ways "disasters are perceived culturally and politically" (Albris et al., 2020, p. 1) in any place or time. Highly regulated systems of land use and building development, for example, may presume more limited community capacity or agency. In other examples 'soft' regulation may require (or impose) more responsibility from within the community when disaster occurs, notwithstanding the challenges of understanding and identifying those communities (Räsänen et al., 2020). In many instances preparedness and response, whether regulatory or community-driven, might be considered as simply inadequate and as reflecting broader social and spatial inequities which are manifest as vulnerabilities in place.

The evidence-base for understanding and profiling risk and impact is likewise contained within a cultural and political context. This is not simply to suggest that evidence in public policy is evidently constitutive of the mediation of information to produce sufficient public reasoning through specific a political and cultural context (Jasanoff, 2012), but also that the use of evidence in disaster management is subject to political and cultural prioritisation and the discursive formations that situate these priorities, as well as to power, conflict and the social acceptability of any evidence in informing subsequent policy action, particularly when this clashes with assumed rights (Klatt & Blum, 2024) including personal and property rights. The operationalisation of science and evidence in this way is also subject to the norms of regulatory practices, with notions such as *precaution* and *uncertainty* being familiar concepts that nonetheless do often struggle to find a meaningful place in policy and regulatory decision-making (Zandvoort et al., 2018). This may be considered as part of broader challenges to the traditions of future-orientation that have underpinned spatial planning in more or less certain circumstances.

This is particularly evident in relation to examples such as flood and wildfire, and as we argue in this volume, most critically in peri-urban regions. The tensions between a long-term goal of risk reduction, impact mitigation and an investment in the 'sunk cost' of community infrastructure are clear, alongside ideas of protecting place identity and its political potency. In the face of powerful political and cultural processes such as urban expansion, or the alternative of retaining rural community life, and of managing vegetation, waterways and biodiversity, situating planning for risk and disaster becomes just one of several often-competing policy objectives.

In our examples we can see a series of long-term policy goals in conflict, especially the issues of private property rights, housing demand and the provision and protection of public infrastructure alongside the significance of such crucial goals as protecting life during wildfire and flood events. But arguably these issues are not simply competing policy objectives, but rather each can be components of a model of land use and community planning that more fully considers changing risk profiles of dynamic peri-urban locations. Another aggravator is the inherent institutional weakness of governmental agencies in the face of urbanisation priorities, sometimes combined with lack of leadership, and in most of our case studies the product of a longstanding retreat of the state and reflexive deregulation of urban development.

This in turn raises a series of policy choices and perspectives that factor in the case studies in this book. These include the emphasis on the tight control and regulation of risk and of land use exposure compared with models and systems of political culture that concede that risk is inherent, as well as considering those approaches that focus on centralised and institutionalised prevention and response contrasted with those settings where individual or community agency is seen as significant. Realistically, most examples are not at either end of these choices, and they reveal the dynamic nature of policy approaches to complex environments. Important however is the contrast between assumptions about where and how knowledge and capacity is centred in response to risk that is focussed on ecological and social relationships in peri-urban areas, whether as expert-derived or as multi-centred knowledge and action and if these are actually useful responses (successful policy) in different circumstances and at different stages of disaster avoidance, prevention and recovery.

This then exposes a useful thread of consideration regarding the role of government and community, and approaches to community *resilience* and the operationalisation of resilience as a public policy objective in complex systems exposed to risk, including under climate change. Resilience whether as a policy initiative or as an ideal characteristic of community is an increasingly prevalent concept, and "whatever it is, [it] appears to be everywhere" (Anderson, 2015). Discourses of resilience as a characteristic of systems, including governance systems, are manifold yet problematic despite the evident suitability of an idea like this to address uncertainty and dynamic risk profiles. Criticisms from within disaster management literature suggest a lack of empirical foundation for the concept (Brown, 2012) or that it operates within particular modalities of governance and

economy, effectively (and deftly) passing responsibility from the state to communities (Konings, 2016; Ruszczyk, 2019). As Parker (2020) identifies the 'science' of disaster resilience (i.e., actually measuring and then understanding what contributes to resilience and how to have more of it) is contested and under-developed, despite the general sense that resilient community or policy approaches are a good idea. In turn this raises fundamental questions about policy, responsibilities, priorities and approaches. In our case studies the priority given to directional, government-led (and often top-down regulatory) approaches is of significant interest in reducing risk exposure, particularly as it results from population growth and housing development beyond urban boundaries, making places part of a complex urban system, implicitly worthy of urban levels of governance, investment and support. However, community capacity, resilience and engagement in contextually relevant policy approaches remain significant as potential solutions in many of the examples we discuss, where community co-operation, preparedness and acceptance of known risk and hazard are crucial part of disaster management at all stages. Dilemmas arise under what Chandler (2016, p. 27) describes as the *societalisation* of security, whereby approaches to security are shifted from the state to individuals, including through increasing 'resilience' or by creating 'social capital'. In peri-urban regions this exposes questions of what and who should be resilient and prepared, the role of the state and the meaning of community, place and identity in changing regions.

1.3 'Failure' as a Policy Analytic

Assessing policy failure, and utilising this as an analytical device, offers one insight to understanding the events described in this book, at least in terms of recognising how policy success might be defined, and how policy lessons are learnt and operationalised in the context of often profound disaster and disruption. Our examples are typically high-impact events. Their risks are broadly understood, but action is often constrained by the prioritisation of various policy choices, and by the decisions of a wide range of actors, many in direct response to the history of policy failure. Their local context in peri-urban regions reveals already evident tensions in government and community expectations of place and its transition.

To consider failure, and indeed catastrophic failure in public bureaucracies (Seibel, 2020), as a strategic learning about policy requires due ethical consideration. These events are often deadly and traumatic. Blame, failure

and hesitation to seek seemingly drastic solutions (policy inertia) are each significant elements of a policy and political response, and often typify public reaction. Nonetheless, examples of policy failure, even within those disasters often deemed 'natural' or unavoidable, provide insight to institutional weakness and to normative approaches to problems and problem-solving that are left unquestioned. The insight extends to the roles of technology, information and politics and to the ways that knowledge and evidence for part of public and political reasoning throughout stages of disaster preparedness, response and recovery.

Key dimensions of the repeatable nature of public policy, particularly land use policy and regulation, are their legitimacy and public acceptance. To impose proscription, or conditions on the use of private land and its development, particularly as housing, typically raises a range of conflict, yet the rationality of ordered development, particularly when protecting landscapes, public assets and protecting communities from risk and hazard, appears likely to be acceptable when information is clear and agreed upon. This suggests that disaster preparedness and response through land use effective regulation is certainly possible, given these are often policies that guide a regulatory system of incremental, individual decisions, such as the development of housing in peri-urban regions which in turn increases risk, exposure and vulnerability. However political acceptance often rests on notions of procedural fairness of decisions and the equitable distribution of impacts within the community, and between peri-urban communities and other areas (such as the city itself). Consequently, seeking procedural acceptability exposes a public policy environment where inertia may be considered preferable to change and potential political or community conflict, despite evidence (e.g., new risk profiles for flood or wildfire), and where disaster events exposing these contradictions may not in themselves be sufficient to resolve policy failure for future preparedness.

1.4 Critical Approaches to Risk and Land Use Policy in Peri-Urban Regions

Peri-urban regions are those areas at and beyond the fringes of cities—liminal spaces between the urban and rural landscapes. While their characteristics are necessarily varied, globally peri-urban land use challenges include population growth and processes of urbanisation, with consequent threats from associated changes in existing land use systems; as agriculture, or 'wilderness' or a place to extract natural resources, for example. The area

includes spaces where the expectations of land use futures are ill-defined, and where contrasts between land (and landscapes) for production and consumption are often in evidence, although the mosaic of land uses in these regions often renders such categories too simplistic (Buxton & Butt, 2020, p. 19).

Regulating land use change through spatial planning is a widely accepted and practiced area of public policy and regulation, including in peri-urban areas, although the fundamental aims and purposes of these policy approaches are often poorly defined beyond traditional urban environments where purpose and ultimate strategy remain contested. The origins of contemporary spatial planning systems are usually considered to have emerged in the challenges of managing unregulated nineteenth-century industrial urbanisation and have been conceptualised within strongly modernist framings of efficiency and land use and development categorisation. However, in practice there are evident limits to governance and regulation through land use regulation, whether in high-, middle- or low-income economies, particularly in an era with market-led solutions and resource financialisation and dominant models of governance. Tensions between land markets and regulation are prevalent whether reflected through institutional weakness of government to regulate and enforce such restrictions, or through the policy deference given to markets and investment priorities under neo-liberalism.

For peri-urban areas in particular, spatial planning has generally emerged from two complementary policy loci: the prevention of urban sprawl in an era of increasing daily mobility and the protection of place, particularly the protection of agricultural landscapes as economic and cultural assets. In practice this means that spatial planning responses to these processes are often guided by multiple and intersecting priorities.

Attempting to manage urbanisation and its intrusion into peri-urban places include managing urbanisation by regulating and limiting dispersed housing and preventing disordered (if not informal) development processes, perhaps reflecting a stance that peri-urban places are urban-in-waiting or the 'not-yet city' (Angelo, 2017, 158). In this way peri-urban planning policy primarily seeks to act as limits to sprawl and to bound the growth of the city. In this view, rural and peri-urban places may be "portrayed as a mere backdrop for the more spectacular processes of urbanization" (Cairns, 2019, p. 119) rather than places with dynamics of change and dilemmas in policy that are both distinct and significant.

Alternatively, peri-urban planning practices may be driven by priorities to protect agricultural systems, urban water catchments or rural community life and its associated landscape and amenity values. In this framing, the key policy priorities seek to limit urban encroachment and conflict between land uses, despite the hybrid and often-changing character of peri-urban landscapes. This can particularly expose tensions in policy relating to disaster prevention or preparedness where the protection of 'natural' landscapes (e.g., areas of vegetation) presents increased wildfire exposure and risk for new and existing housing, even when this is not at urban densities.

Consequently, typical approaches to peri-urban planning are the regulation and proscription of new housing and of the fragmentation of private land holdings below that deemed to support agricultural activities. In many jurisdictions, including those discussed in this volume, such approaches have a long policy history (see Cloke, 1989; Caldwell et al., 2017) and reveal what Lapping (2006, p. 118) describes as an "amazing consistency and lack of imagination" in policy approaches to prevent the dilution of farming and the urbanisation (if by stealth) of peri-urban areas. These attempts belie the two key challenges of such policy approaches: firstly that peri-urban locations often offer attractive locations for new housing, and that preventing new housing has implications for growing cities. The latter has been described in the UK context by Sturzaker and Shucksmith (2011, p. 169) as an "unholy alliance between rural elites and urban interests" that has framed land for new housing as inherently unsustainable despite the socio-spatial justice implications of urban containment. Generally, peri-urban land use controls continue to exist despite realities of land use change and the dilution of genuinely rural activities in these locations.

Beyond farmland protection, threats from peri-urbanisation to the health and quality of natural systems are critical concerns of planning systems: whether to biodiversity or to resources such as urban water supply. Conversely however, the threats to new urban, or urbanising populations, from these assets and resources are also significant, potentially exposing communities to hazards that manifestly increase with population growth and urban expansion, particularly where nature, wilderness, managed forests and catchments intersect with new housing.

Urban systems are complex, as are the peri-urban systems they influence. Consequently, priorities for public policy through spatial planning and land use regulation are often in tension and are often contested. The

use of peri-urban places as spaces for urban expansion and for necessary urban resources can expose these priorities in conflict: affordable housing, nature conservation, resource protection, tourism and recreational spaces. These in turn present a complex and dynamic risk profile in peri-urban areas which reflect an interplay between hazards, public policy aims and capacity or resilience within diverse communities.

Risks in the regions emanate from the confluence of hazards, including flood and fire, alongside exposure resulting from increasing population and housing and the vulnerabilities of new communities, often less attuned to the resilience and response required in these settings. Tensions between policy certainty and addressing changing risk profiles and between a 'methodological' neo-liberalism and what may be realistic and achievable expectations of the state and community in these areas. Attempts at adaptive governance (Folke et al., 2005) are evident, within a realisation of the multiplicity of interests in planning. However, with reference to wildfire, Gillen (2005) identifies that there is often a "mismatch between reactive technological fixes and proactive social programs" to embed them and make them useful. The policy failure in this case is one of seeing connection and relationship, especially at a city-region scale. Urban planning policy is both predictive and reactive, and socio-political decisions impose greater risks in peri-urban areas with a wildland-urban interface, often due to a public and political unwillingness to clearly decide the roles of these sites, creating "manufactured uncertainties" (Beck, 2009) and consequent (often incalculable) risks to satisfy the multiple expectations of the locations as nature, and home, as resource, and other uses.

1.5 Disaster, Risk and Policy Explorations: Managing Flood and Fire

Flood and wildfire, particularly on and beyond the urban fringe, offer two examples of hazard and risk that are subject to dynamic change under urbanisation and climate change. Longstanding policy concerns are evident in each case in many jurisdictions, but in many locations these offer new and poorly anticipated hazards—for example, for growing, and alarming, extent of wildfire observed in the Northern Hemisphere summer of 2023.

These hazards occur in ways that have varied levels of predictability, and historical knowledge of the threats are known, but often inadequate tools for comprehensive planning to avoid exposure of communities. In

addition to broader uncertainties projected under climate change, localised changes—for example, the changing nature of flood regimes under urbanisation—create new uncertainties in locations where risk and vulnerability may have appeared as settled policy questions.

Public policy responses, including through land use planning policy, are varied, yet often exhibit an inability to address the complexity of competing objectives for urban (and peri-urban) change. The policy approaches described in this volume suggest difficulties in addressing precaution in planning, in legitimacy for policy dealing with infrequent hazards (although in many examples frequency and exposure increases under peri-urbanisation) and missing pathways from policy to implementation, especially under competing policy priorities.

Typically tensions that exist in planning policy around this topic are between logics of excluding development of risky locations and of engineering solutions (e.g., flood mitigation or vegetation clearance). Usually neither presents as politically or financially achievable. Peri-urban regions are popular locations, whether for relative affordability or for distinct lifestyle advantages when compared to cities. Projects seeking to tame nature are increasingly seen as unsuitable and maladaptive.

The critical land use planning issues that emerge in the case studies described in this book are of scale, urgency and uncertainty. Both flood and fire as examples in peri-urban regions show that past practices, whether as exclusion or mitigation, are simply insufficient for the growth in impact that has been witnessed in recent years as events have become more ferocious and populations greater, and more exposed.

The uncertainty of disastrous events (e.g., scale and seasonality) creates challenges for public policy systems such as land use planning that usually seek both evidence and consensus as ideal approaches to decision-making. As can be seen from our case studies, policy systems derived from these principles may struggle to implement sufficient precaution and to maintain priorities for disaster management in the long term. Moreover, the legitimacy and acceptance of evidence under uncertainty raises challenges for land use planning systems. The resources required to establish dynamic and precautionary data have proved challenging in relation to peri-urban flood and fire, and public discourses surrounding dynamic understandings of hazard and risk may not be supportive of restrictive planning within the context of broader urban issues such as housing affordability, population growth and infrastructure investment. In this regard, a public interest response is complex and contested, particularly with a long-run framing.

1.6 Mapping the Book

Based on exemplary case studies on wildfires and flood events in Argentina, Australia, Greece, South Africa and the USA, the following chapters analyse how inappropriate public policy strategies and institutional failure, particularly peri-urban land use policy, reveal a systemic lack of preparedness in the face of natural hazards, especially planning approaches that do not reduce exposure and risk. While appropriate strategies may be hard to implement due to local resistance and inconsistency of administrative implementation, the logic of risk and hazard exposure, preparedness, response and recovery requires politically challenging approaches. Operating at the wildland-urban interface, and in regions where the risks inherent are often fundamental features of landscapes, genuinely strategic and adaptive responses are necessary in these dynamic environments.

While counterproductive governmental action unnecessarily aggravates the consequences of natural hazards in terms of destruction and loss of human lives, the cases under scrutiny also reveal where public policy change and improvement of local administrative capacity are both desirable and possible. This reveals scope for more mindful and comprehensive spatial planning and the avoidance of local political compromises resulting in more effective risk reduction and sustainable land use.

The selection of cases follows a threefold logic. First, it covers the two types of natural hazards whose growing scale and scope represent the most dangerous short-term consequences of global warming: wildfires and floods. Second, the case studies address challenges of local spatial and urban planning, namely the management of the wildland-urban interface (WUI) at the "urban fringe", local housing policies and the enforcement of urban planning codes as well as the design and enhancement of protective infrastructure. Third, the cases represent conditions where increased threats of natural hazards coincide with functioning governmental and administrative structures. This implies that ineffective governmental response cannot be ascribed to generic state incapacity and that appropriate policy alternatives are realistic and feasible if understandings of risk and precaution can be adequately incorporated in land use policy. The case analyses themselves are based on sound and objective documentation produced by investigation committees and/or third-party scholarly research and expert reports.

Chapter 2 presents the case of wildfire (bushfire) in South Eastern Australia, particularly surrounding metropolitan Melbourne. This area is

highly fire prone, including fire-dependent forests where fire incidence and frequency are evidently affected by climate change, and exposure rapidly increased under urbanisation. Policy approaches to reducing risk and hazard, particularly in the siting of new housing, conflict with expectations of landscape and amenity in this peri-urban region. The chapter argues that while risk approaches to building design and siting have occurred, genuine anticipatory planning to reduce exposure in these landscapes has been avoided, as have approaches that recognise the increasing uncertainty presented by wildfire in coming decades.

Chapter 3 explores the tragic 2018 wildfires in the peri-urban surrounds of Athens, Greece. A key focus of this case study is the disaster response in the immediate event and its aftermath. The politics of blame and responsibility trace through issues of preparedness, inadequate regulatory enforcement and questions regarding the remit of the state. The key lesson (and perhaps the key failure) appears as a lack of political willingness to address broader dimensions of risk and hazard reduction through systematic reduction of fuel loads in the peri-urban region and changes to building regulation and enforcement.

Chapter 4 considers the relationship between government and the private sector in the case of the 2018 *California Camp* Fires in California, USA, and the various responsibilities of a local utility company, local and State government and how these interacted with community preparedness. This final point introduces the role of social cohesion and community resilience (and capacity) to both prepare and recover, and how a *sense of community* can both stimulate risk-increasing and risk-reducing behaviour in local communities.

Chapter 5 re-emphasises that lessons learnt from previous disaster events have not produced strong structural reforms in planning approaches. Using the examples of flood events and planning in La Plata, Argentina, the chapter follows a particularly interesting 'least likely' case to examine the causes of the failure to achieve an integrated approach to flood management, despite the city's strong urban planning culture and the existence of an advisory body for many years which included expert voices that were aware of the factors that made citizens more vulnerable to flooding. The case analysis reveals that the lack of coordination is not only explained by missing structural coordination mechanisms, but that a process of administrative and political decisions made changes to non-structural measures to complement infrastructure projects impossible.

The final case study (Chap. 6) offers a critical appraisal of the *Build Back Better* approach to disaster recovery in the Western Cape Province, South Africa. The chapter highlights the mismatched relationship between legislation, policy and practice. The lack of political commitment to Build Back Better principles, coupled with the cumulative nature of multiple events and their recovery periods, reaffirms the need for an all-off-society approach that engages the public and private sector as active role-players in risk reduction.

The threads of experience from these cases are discussed as a conclusion that connects the policy failure of varied locations and the cultural and political diversity described. Critically, the conclusions offer a focus on the role of public policy and public agencies. The lessons suggest that confidence in regulation is significant with examples such as Australian reliance on deregulation or the lack of coordination in Argentinian housing policy revealing serious yet unintended consequences in peri-urban landscapes. While the interplay of culture, socio-ecological systems and property markets are all important in shaping peri-urban places, and in understanding risk and resilience, there is also a clear role for the state in determining peri-urban futures. The policy failures explored in these case studies vary, yet reveal consistencies with respect to difficulties in policy understandings of a clear role for peri-urban regions and in determining roles for the state, communities and markets. Most evidently, these examples also reveal significant potential for future challenges for policy development under climate change, as each of these cases refers to discrete events which occur under longer-standing social, environmental and political contexts. The urgency of transformative approaches to managing these locations is clearly evident.

References

Albris, K., Lauta, K. C., & Raju, E. (2020). Disaster knowledge gaps: Exploring the Interface between science and policy for disaster risk reduction in Europe. *International Journal of Disaster Risk Science, 11*, 1–12.

Anderson, B. (2015). What kind of thing is resilience? *Politics, 35*(1), 60–66.

Angelo, H. (2017). From the city lens toward urbanisation as a way of seeing: Country/city binaries on an urbanising planet. *Urban Studies, 54*(1), 158–178.

Beck, U. (2009). World risk society and manufactured uncertainties. *Iris: European journal of Philosophy and Public Debate, 1*(2), 291–299.

Birkmann, J., & McMillan, J. M. (2020, February 28). *Linking Hazard vulnerability, risk reduction, and adaptation*. Oxford University Press. https://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-145

Blaikie, P., Cannon, T., Davis, I., & Wisner, B. (1994). *At risk. Natural hazards, people's vulnerability, and disasters.* Routledge.

Brown, K. (2012). Policy discourses of resilience. In M. Pelling, D. Manuel-Navarrete, & M. Redclift (Eds.), *Climate change and the crisis of capitalism* (pp. 37–50). Routledge.

Buxton, M., & Butt, A. (2020). *The future of the fringe: The crisis in peri-urban planning.* CSIRO Publishing.

Caldwell, W., Hilts, S., & Wilton, B. (2017). *Farmland preservation: Land for future generations.* University of Manitoba Press.

Chandler, D. (2016). Resilience: The societalization of security. In D. Chandler & J. Reid (Eds.), *The neoliberal subject: Resilience* (pp. 27–50). Adaptation and Vulnerability.

Cloke, P. (1989). *Rural land-use planning and developed nations.* Routledge.

Crichton, D. (2007). What can cities do to increase resilience? *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 365*(1860), 2731–2739.

Deslatte, A., Siciliano, M. D., & Krause, R. M. (2023). Local government managers are on the frontlines of climate change: Are they ready? *Public Administration Review, 83*(6), 1506–1511. https://doi.org/10.1111/puar.13726

Essen, M., McCaffrey, S., Abrams, J., & Paveglio, T. (2021). Improving wildfire management outcomes: Shifting the paradigm of wildfire from simple to complex risk. *Journal of Environmental Planning and Management*, 1–19.

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of the Environment and Resources, 30*, 441–473.

Gillen, M. (2005). Urban governance and vulnerability: Exploring the tensions and contradictions in Sydney's response to bushfire threat. *Cities, 22*(1), 55–64.

Hewitt, K. (Ed.). (1983). *Interpretations of calamity: From the viewpoint of human ecology.* Allen & Unwin.

IPCC. (2019). Climate change and land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. In P. R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H. O. Pörtner, D. Roberts, et al. (Eds.). In press.

IPCC. (2022). Climate change 2022: Impacts, adaptation and vulnerability. In H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (Eds.), *Contribution of Working Group II to the sixth assessment report of the intergovernmental panel on climate change* (p. 3056). Cambridge University Press, 3056. https://doi.org/10.1017/9781009325844.

Jasanoff, S. (2012). *Science and public reason.* Routledge.

Klatt, N., & Blum, S. (2024). How does the use of evidence in policy narratives change during crises? A comparative study of New York City's pandemic school shutdowns. *Review of Policy Research* (early online).

Konings, M. (2016). Governing the system: Risk, finance, and neoliberal reason. *European Journal of International Relations, 22*(2), 268–288.

Lapping, M. (2006). Rural policy and planning. In P. Cloke, T. Marsden, & P. Mooney (Eds.), Handbook of Rural Studies, (pp. 104–22). SAGE, London.

Parker, D. (2020). Disaster resilience—A challenged science. *Environmental Hazards, 19*(1), 1–9.

Pyne, S. J. (1995). *World fire. The culture of fire on earth.* Henry Holt and Company.

Räsänen, A., Lein, H., Bird, D., & Setten, G. (2020). Conceptualizing community in disaster risk management. *International Journal of Disaster Risk Reduction, 45*, 101485.

Ruoso, L., & Plant, R. (2018). A politics of place framework for unravelling peri-urban conflict: An example of peri-urban Sydney, Australia. *Journal of Urban Management, 7*(2), 57–69.

Ruszczyk, H. (2019). Ambivalence towards discourse of disaster resilience. *Disasters, 43*(4), 818–839.

Seibel, W. (2020). Are public bureaucracies supposed to be high reliability organizations? *Global Perspectives, 1*(1), 1–17. https://doi.org/10.1525/gp.2020.17643

Sturzaker, J., & Shucksmith, M. (2011). Planning for housing in rural England: Discursive power and spatial exclusion. *Town Planning Review, 82*(2), 169–194.

Von Der Dunk, A., Grêt-Regamey, A., Dalang, T., & Hersperger, A. M. (2011). Defining a typology of peri-urban land-use conflicts–a case study from Switzerland. *Landscape and Urban Planning, 101*(2), 149–156.

Wisner, B., Blaikie, P., Cannon, T., Davis, I., & I. (2004). *At risk: Natural hazards, people's vulnerability and disasters.* Routledge.

Zandvoort, M., Van der Vlist, M. J., Klijn, F., & Van den Brink, A. (2018). Navigating amid uncertainty in spatial planning. *Planning Theory, 17*(1), 96–116.

CHAPTER 2

Risk and Hazard from Bushfire and Flood in Eastern Australia

Michael Buxton and David Mercer

2.1 Introduction

In her foreword to a recent collection of essays on the history of environmental policy, Susan Owens (2022) makes three key observations. The first is that environmental problems are, and always have been, a part of the human condition; the second that vulnerabilities to and impacts of environmental hazards have been unevenly distributed; and the third that many battles are never won but are constantly negotiated and re-evaluated. Invariably negotiation revolves around conflict and blame between national and subordinate governments, non-state actors, individuals and financial institutions. The latter yield substantial power and are becoming

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increasingly involved in debates about who should bear the primary responsibility for disaster risk liability as well as the development of robust methods for the measurement of the biophysical condition of environmental assets (Accounting for Nature, 2022).

Greatly expanded scientific knowledge now plays a crucial role in the negotiation process and is central to this chapter's initial focus on bushfires as an "environmental hazard", specifically in relation to Melbourne, capital of the Australian State of Victoria. As will be highlighted, in addition to long-term health consequences, climate-related disasters such as fires and floods have wide-ranging impacts on the water-energy-food nexus (Brouwer, 2022). Growing recognition of this new reality has found its expression in a number of interrelated international agreements, as detailed below.

Recent years have seen ever-increasing international pressure on Australia and other nations to improve their poor performance on such issues as greenhouse gas emission reductions, sustainable development and biodiversity loss. Since 1995 the country's deteriorating environmental health has been documented every five years in the formal *State of the Environment* reports. The most recent of these, released in July 2022, makes for sobering reading (Australian Government, 2022; Johnston et al., 2022). In particular, it highlights the growing threat to all ecosystems posed by climate change. For the first time, the authors of the 2022 report chose to focus attention on specific, climate-related disasters and also highlight the positive role that centuries-old Indigenous knowledge and management can play in healing damaged ecosystems. Interestingly, the case studies chosen for illustration in the report did not include consideration of less dramatic, though slowly evolving/simmering drought conditions, an enduring feature of the continent which from time to time delivers significant economic hardship. This is the distinction between two ideal types in the crisis management literature: 'fast-burning' and 'slow-burning' crises (Boin et al., 2020).

Climate change and its contribution to natural disasters will receive considerable attention in this chapter. But, following recent Conference of the Parties to the United Nations Climate Change Convention discussions, Australia is by no means alone among affluent nations in its "active inaction" on this issue (Rahman, 2023). One recent, development was the Commonwealth Government's decision to cease funding for the Decadal Climate Forecasting Project. This internationally recognised scientific programme was started in 2016 but was abruptly terminated in 2021

(Hannam, 2022). The government elected in 2022 has taken only moderate steps to improve Australia's performance on climate change policy and the challenge remains for it to commit to more robust climate policies (Morton, 2023).

Relatedly in 2015, together with 186 countries, Australia ratified the *Sendai Framework for Disaster Risk Reduction* (SFDRR) (United Nations, 2015). The Framework is the latest development in the formulation of collective action with a genesis in the 1990–1999 International Decade for Natural Disaster Reduction (IDNDR). The United Nations (2016) defines disaster resilience as:

> The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.

We shall return to this landmark international agreement and its relevance at the local operational level in Australia later in the chapter. At this stage we would simply highlight *Priority 1* of the Framework: *Understanding Disaster Risk*. This elevates knowledge and its generation as the foundational priority for the Framework (Weichselgartner & Pigeon, 2015). In an age of highly contested media misinformation, this raises the issue of who controls knowledge and its associated messaging (Lopez, 2023; Nohrstedt et al., 2022). Supran and Oreskes (2020) have undertaken a forensic analysis of ExxonMobil's internal documents and communications relating to climate change and have exposed the company's consistent public denial of what they knew and what scientists were telling them.

Together with 192 member states, the year 2015 also saw Australia commit to the achievement of 17 clear goals through the *2030 Agenda for Sustainable Development* with 169 detailed target actions. *UN Sustainable Development Goal (SDG) #11* focuses on Sustainable Cities and Communities and obliges signatory nations to "make cities and human settlements inclusive, safe, resilient and sustainable" (UNEP, 2020). These are noble sentiments, but as Dawes (2019) explains, this highly generalised objective intersects with no less than nine other SDGs resulting in numerous ethical dilemmas in working towards this goal's achievement in specific settings (Bennett, 2019).

In a recent study Biermann and his colleagues (2022, pp. 795–6) presented the results of their exhaustive analysis of the observed political impact of the Sustainable Development Goals. They utilised the tripartite categorisation of impacts—*discursive, normative and institutional*—commonly used in the policy analysis literature and concluded:

> We find that the SDG thus far have had mainly discursive effects. … However, effects are often diffuse, and there is little evidence that goal-setting at the global level leads directly to political impacts in national or local politics … although there are some limited effects of the SDGs, they are not yet a transformative force in and of themselves.

A consensus is slowly emerging that the old 'normal' will never be recovered (Goodspeed, 2020; Milne et al., 2020). In particular, the global COVID-19 pandemic has created enormous challenges for the attainment of the SDG goals. Even so, an audit conducted in 2020, prior to the pandemic, also confirmed the Biermann et al. (2022) assessment that progress on many of the goals was well behind target. This was particularly the case in relation to Climate Action (SDG13) (Sachs et al., 2021; World Economic Forum, 2021).

A common response in cities and regions in the aftermath of major natural events is an examination of how urban planning regulations and practices might contribute to disaster mitigation (Johnson & Olshansky, 2017). Feldmann-Jensen and colleagues (2017, p. 45) have argued that the multiple actors now involved in the contemporary emergency management/disaster/risk management (EM/DRM) field are facing

> unprecedented value-based choices. Examples of such choices include deciding between strong governance and individual freedoms to live in places of high risk, economic growth versus environmental health, and to what degree societies engage in the socialization of risk.

In particular, the recent COP15 deliberations in Canada over the global biodiversity framework have highlighted the challenging dilemma of satisfying both the requirements of SDG#11, on the one hand, and the 23 targets of the Kunming-Montreal agreement, on the other (Bekessey et al., 2022). Defined as 'disasters', floods, for example, invariably create enormous economic damage. By contrast, they can also deliver equally

large regeneration benefits to the flora and fauna of floodplain and wetland ecosystems.

Our discussion here will relate the concept of 'risk' to those of 'liveability', 'amenity' and 'wellbeing' by investigating how risk and hazard can affect the vulnerability of urban-edge areas to bushfires, that is, their propensity to be harmed. The chapter first applies this analysis to the increased risk from bushfires, principally in south-eastern Australia and the State of Victoria, followed by a focus on floods, primarily in coastal regions of South East Queensland and New South Wales. Recent years have seen arguably the most catastrophic fire and flood events in Australia's post-colonial history. Total damages from the 'Black Summer' fires of 2019/2020 have been assessed at around $100 billion (AUD) (Read & Denniss, 2020); and for 2022 alone the east coast floods have been calculated to have cost the economy some $5 billion to this point (Clun, 2023).

The concept of 'risk' is defined and then explored through an examination of two elements: 'likelihood' and 'consequence'. This forms the basis for the argument that two factors are contributing to increased levels of bushfire and flood risk: firstly, radically changing environmental conditions, principally the large-scale expansion of settlement into peri-urban areas (Bradstock & Gill, 2001; Buxton et al., 2011a); and secondly, anthropogenic climate change (Colvin et al., 2020; Canadell et al., 2021). Land use, ownership and management form a fundamental context to this chapter, as emphasised by the OECD in its 2017 study of comparative land use governance, commenting:

> Land use affects the environment, public health, economic growth, the distribution of wealth, social outcomes and the attractiveness of cities and towns. Land-use practices have major consequences for climate change mitigation. Land use has been linked to approximately one-third of all man-made CO_2 emissions. (OECD, 2017, p. 14)

We begin with some basic background information on the climate and geography of the State of Victoria in south-eastern Australia to provide a context for the analysis of risk from bushfire and flood.

2.2 Victoria and its Capital

Victoria is one of eight jurisdictions in a federation of Australian states and territories affected by climate change and its interrelated impacts which extend beyond artificial political boundaries and the divide between public and private properties. Weak policy for dealing with natural disasters—both within and between States—persists as a serious issue in Australia. This was highlighted both in the Final Report of the 2020 Royal Commission into National Natural Disaster Arrangements (2020) and in the 2021 Australian *State of the Environment* report. As well, policy reforms and related financing put in place under one government—whether State or Commonwealth—are commonly overturned following the election of a new government. Australia's polycentric jurisdictional structure allows for both progressive and regressive policy experimentation in one State which may then be taken up by other States or the Commonwealth government. For example, until January 2023, primary responsibility for planning and environmental matters in Victoria was assigned to one, overarching State government authority, the *Department of Environment, Land, Water and Planning (DELWP)*. But following a State election in November 2022, an administrative restructure saw a potentially serious weakening of this integrated policy arrangement by the creation of two new departments, that of *Energy, Environment & Climate Action (DEECA)*, on the one hand, and *Transport & Planning*, on the other. On the other hand, the Federal Government's newly appointed Climate Change Minister has acknowledged that "[n]atural disasters are increasingly less natural. They're less natural because they're caused by human-induced climate change. This is a statement of scientific fact" (Hannam, 2023, p. 11).

Victoria is located in the south-eastern corner of mainland Australia, bordering the much larger States of New South Wales and South Australia. It has a land area of some 230,000 sq. kms, similar in size to that of Romania and the United Kingdom. This is small by Australian standards and equates to only around 3 per cent of the country's land area. However it is one of the world's most fire-prone regions, historically sustaining about 50 per cent of the economic damage from the country's bushfires and suffering over half, or 296, of the deaths from bushfire between 1900 and 2008 (Buxton et al., 2011b). Continued further loss of human and animal life and damage to property has occurred since then, as detailed below.

The Murray River forms the State's border to the north with New South Wales. To the south an 1100-km coastline abuts Bass Strait. The state's northern hemisphere latitudinal equivalent is southern Spain and Athens. It has a temperate oceanic climate but its location between the cold Southern ocean and the hot inland provides ideal conditions for the formation of often highly energised cold fronts triggering extreme weather changes in the summer and spring months. These include sudden onsets of high winds, hail and torrential rain from the south-west which intersect with narrower fire fronts driven by hot north summer winds to dramatically broaden new fronts with devastating consequences. The peri-urban area of the capital city, Melbourne, is one of the world's most susceptible to catastrophic bushfires.

Major seasonal temperature variations are a characteristic feature of the Melbourne area in particular. Historically, these have swung between the extremes of −2.8 °C in winter to 46.4 °C in summer. Bushfires are common in the drier summer months and can be classified in terms of both "area burned" and "destruction to life and property". The two are not necessarily synonymous. Large fires can occur in sparsely populated parts of the State and relatively small fires can inflict extensive damage to settlements. Especially extensive fires occurred in 1851 (5 million hectares), 1938–1939 (2 million ha.) and 2020 (1.5 million ha.). The highest recorded death rates occurred in February 1926 (60 deaths), January 1939 (71) and February 2009 (173). The high death toll from the latter fire on 'Black Saturday' occurred in relatively restricted forested and grassland areas to the east of Melbourne.

Victoria is currently home to approximately 7 million people and is the most densely populated of all Australian States and Territories. The population is also highly concentrated in the coastal Greater Melbourne region in the south, where around 70 per cent of the population resides. Three other regional cities—Geelong, Ballarat and Bendigo—lie in Melbourne's peri-urban zone and are among Australia's 20 largest cities. Greater Melbourne has grown rapidly since the Second World War and low-density suburban sprawl is its most characteristic feature. The urbanised area now extends over an area of some 10,000 sq. kms., greater than that of Jakarta. Recent projections point to Melbourne being Australia's fastest-growing capital city in the near-future, making it the nation's largest city by 2029 with an estimated population of around 6 million people, and an additional 3 million by 2050 (McKeown, 2022).

Based on the longstanding UK experience with 'green belt' buffers, since 2002 successive State governments have attempted to slow the rate of outward expansion of the city by the establishment of a legislated Urban Growth Boundary (UGB). Land and housing development interests have successfully lobbied to weaken the UGB (Buxton & Butt, 2020; Taylor, 2015). A weak regulatory environment has led to Melbourne expanding continually in all directions into native grassland and hilly forested areas with a long history of fire vulnerability. The Dandenong Ranges to the east of Melbourne present a classic example. Enlightened foresight in the nineteenth and early twentieth centuries would have seen this densely forested area designated as what now would be a world-class national park (Goldin & Ripley, 1974). Advocates for that outcome were effectively silenced. Instead, a process of largely uncontrolled, small-lot subdivision was allowed for decades.

In common with the Mt. Lofty Ranges on Adelaide's eastern fringe, the result is a dispersed, highly populated and dangerously fire-prone area with a poorly coordinated transport system providing limited access for both firefighters and evacuating residents (Bond & Mercer, 2013; Bardsley et al., 2015). Major fire events occurred in the Dandenong Ranges in 1962 and 1983, resulting in Melbourne suffering serious ash fallout and being blanketed in smoke for days after. This acted as a reminder that bushfires have both immediate and longer-term *indirect* impacts, often far from the fires themselves (Ebi et al., 2021; McManus, 2021). Using conservative assumptions in their modelling, Ademi et al. (2023) argued that in the decade up to 2030 the likely impact of bushfires on gross domestic product will be $172 billion with 2400 bushfire-related deaths Australia-wide and healthcare costs related to smoke issues of $110 million. Expected health costs continue previous trends, such as from the so-called Black Summer bushfires of 2019–2020 which resulted in 34 direct deaths but an estimated additional 417 deaths from long-term smoke exposure.

Australian Bureau of Statistics data for recent years have identified six or more peri-urban local government areas around Melbourne as having the highest rates of population increase in the country. About 250,000 people on the fringes of Melbourne and another 250,000 in regional areas live in high-risk locations. Housing and population growth only exacerbate this vulnerability by introducing a multitude of new ignition possibilities. *Plan Melbourne* is the State government's strategic blueprint for the city's growth trajectory to 2050. First released in 2014 and then revised in

2017, it recommended that new housing on the urban fringe be limited to 30 per cent of all new dwellings, yet in 2021, 56 per cent were constructed in 'greenfield' fringe estates and 52 per cent in 2020 (Hatch, 2022).

2.3 Risk, Likelihood and Anticipatory Planning

Risk generally is taken to mean the likelihood of an event occurring which leads to undesirable consequences. Risk is the potential for human exposure to hazard and is a voluntary event while hazard arises as a consequence and is a potentially harmful substance or event to life, property or natural resources, natural or human induced, and usually involuntary or unseen (Ingles, 1991; IPCC, 2023). The concept of risk is variously defined. In Australia, the 2009 AS/NZS ISO 31000 *Risk Management Guidelines* replaced the definition in the previous standard from "the chance of something happening that will have an impact on objectives" to "the effect of uncertainty on objectives". The 2018 *Risk Management Guidelines* reworded the seven principles of the 2009 standard. However, this document emphasised that risk management will continue "to apply risk treatment options to ensure that the uncertainty of their agency meeting its objectives will be avoided, reduced, removed or modified and/or retained".

This approach is followed consistently. Risk assessment is the process of identifying and anticipating hazards, or adverse events, while risk management is the process of developing and implementing a strategy for mitigating impacts (Ishiwatari, 2022). Uncertainty analysis extends beyond risk assessment to situations where the nature of future possible events may not be known with the result that probabilities cannot be assigned to their outcomes (Peterson, 2006; Gullett, 2000). After considering the 1985 US Society of Risk analysts list of 13 definitions, Beer and Ziolkowski (1995) proposed that risk involved the union of a set of possible consequences and their probabilities of occurrence in a particular time frame. The *US Fourth National Climate Assessment* related a definition of risk to both uncertainty and climate change and is consistent with the IPCC definition. It defines risks

> in a qualitative sense as threats to life, health and safety, the environment, economic well-being, and other things of value to society … [or] in quantitative terms: estimates of how likely a given threat is to occur (probability) and the damages that would result if it did happen (consequences). Climate

> change … presents uncertain … consequences for natural and human systems across generations. It is characterised by multiple intersecting and uncertain future hazards and therefore, acts as a risk multiplier that interacts with other stressors to create new risks or to alter existing ones. (Reidmiller et al., 2018, p. 44)

'Fire hazard' is measured by the intensity of fire and is calculated by a combination of fire danger and the type, quantity and dryness of fuel, topography and meteorological conditions. Soil moisture content was long ignored as a relevant factor but has become increasingly recognised as an important indicator. Fire danger, or the exposure to harm, is measured commonly by the McArthur Fire Danger Index (FFDI), applied widely by jurisdictions across Australia. This index estimates the likelihood of a fire starting, the rate of its progression and difficulty of suppression by combining meteorological information on temperature, humidity and wind with fuel dryness to produce a measure between 0 and 100 in five categories of 'extreme', 'very high', 'high', 'medium' or 'low'. Fire risk, however, "needs to incorporate some measure of the probability of ignition actually taking place" (Beer & Ziolkowski, 1995, p. 21). An FFDI reading of 50 or more is considered 'extreme' and the trigger for declaration of a Total Fire Ban. The FFDI readings for Victoria on February 7, 2009, were in excess of 300.

These two factors, likelihood and consequence, can be dissected into further components: *likelihood* to the probability of ignition from various sources, and prevention or mitigation through land use planning and other techniques; and *consequence* from hazard related to fuel-reduction practices, suppression effectiveness and the vulnerability of life and property. We now turn to examine these two factors.

Victoria's statewide risk assessment system focuses on *consequences* but not the *likelihood* of ignition. Assessing likelihood from natural causes such as lightning strikes or from human activity, including arson and campfires, is essential if bushfire risk is to be properly evaluated. The ability to measure such elements as vegetation condition and weather is also essential if risk in specific locations is to be accurately assessed.

The likelihood of harm or damage is also affected by attempts to limit consequences by preventing fires or limiting their effects. Anticipatory planning is an important but much overlooked tool for reducing the likelihood of catastrophic impacts from bushfires. The possibility of rapid, nonlinear change, once critical thresholds are exceeded, requires such planning

for alternative futures and rigorous alternative policies to achieve such ends. Both Lagadec (2009) and Keating and Handmer (2022) have proposed a paradigm shift in the way we think and act in relation to hypercomplex crises such as bushfires. Planning for uncertainty should involve anticipatory planning for risk from factors such as climate change at the upper levels of scenarios, a precautionary approach to decision-making and the introduction of regional cross-sectoral policies designed particularly for high-risk peri-urban areas. We also heed the call of Cutter (2016) and Ismail-Zadeh et al. (2016) for a transdisciplinary paradigm shift in disaster science. Yet policy-making is largely reactive for peri-urban regions, orientated to current market preferences and presumed future performance. In a context of increased uncertainty these approaches are inadequate responses to new, heightened levels of risk.

In Australia land use planning is the responsibility of State and local governments. Macintosh et al. (2015) point to the important role of land use planning in reducing vulnerability, limiting risk and preventing harm from natural disasters. Land use planning consists of the strategic and statutory elements of a planning system designed to influence land use and development and achieve strategic objectives and spatial outcomes. Such systems can be designed to facilitate or control the use and development of land. However, their use to prevent or limit harm from major bushfires has not received the attention it deserves. Both Macintosh et al. (2015) and Duhr (2023) refer to the limited attention in urban and regional planning scholarship paid to the study of policy instruments although their application to land use measures is well understood in land use planning practice.

Most planning systems in Australia are primarily deregulatory and have led to a proliferation of dwellings and other developments which are inadequately sited and poorly equipped to protect life and property from bushfires, floods and other natural disasters. A debate is emerging internationally on the potential effectiveness of land use regulation to reduce risk primarily by preventing the continued expansion of settlement into bushfire-prone areas (March et al., 2020; Siembieda, 2020; Ruane et al., 2022) and this debate in Australia is now being extended to flood-prone areas. Local factors such as climatic variations, settlement history, dwelling density, topography, vegetation and fire history can all be considered in the process of such anticipatory land use planning. Recent catastrophic bushfires and floods are leading to improved construction standards designed to protect buildings from bushfires. Other measures, such as property acquisition for

high-risk properties, are also beginning to be implemented. However anticipatory policies to prevent or reduce risk and the likelihood of harm have been used only rarely.

Adaptive management increasingly is regarded as the most effective way to build capacity in times of rapid and fundamental change. Folke et al. (2002, pp. 6, 24, 3) draw on Complex Systems Theory to propose a dynamic view of nature and society in which the "complex non-linear relations between entities under continuous change and facing discontinuities and uncertainty from … synergistic stresses and shocks" are emphasised. They argue that, when applied to land, this approach requires adaptive management and open institutions. They also reject market-based measures, such as economic valuation, because these seldom consider the "inherent complexities and resulting uncertainties associated with ecosystem management and natural capital assets in general … [and ignores] … the slowly-changing probability distributions of critical ecosystem thresholds" (with reference to Carpenter, 2002). The adaptation process may be "reactive or anticipatory, autonomous or planned" (Stanley et al., 2013, p. 32). Adaptation may involve substitution of threatened assets, structural defences to increased threats, greater support to threatened communities or even abandonment.

Adaptive management is often contrasted with regulatory imposition of stability as a control mechanism which is unable to adapt to a dynamic world and can lead to further degradation of resources and detrimental social and economic impacts (Folke et al., 2002). However, the twin aims of regulatory anticipation and adaptation need not be incompatible and may be mutually supportive, depending on the type of regulatory control. Regulation may be based on empirical studies and constitute sound, integrative, strategic responses to emerging needs. It may include in-built adaptive mechanisms and respond rapidly to trends and preserve long-term options. Resilience is the capacity of interconnected social, economic and ecological systems to respond and adapt to hazard in ways which maintain their functions and capacity for adaptation (IPCC, 2023). A resilient community "demonstrates preparedness" (Boon et al., 2012, p. 23), and resilience is served best by prevention requiring anticipation of events. Regulation is often the most effective way to prevent harm either by preventing or minimising the impacts of hazardous events or by putting in place effective response measures well in advance of specific episodes.

2.4 Risk and Consequence

To address consequence, risk management systems are commonly used to minimise risk from bushfire to life and property. Fuel management is commonly used as the major tool to reduce bushfire risk and assist suppression activity. Historically, the Victorian government has used the Phoenix RapidFire bushfire behaviour modelling tool to assess fire behaviour and its consequences, particularly on life and property, review the effectiveness of planned burn scenarios and inform fuel management strategies. This methodology is based on a number of assumptions and its performance against other tools and real events needs to be further verified. The former Department of Environment, Land, Water & Planning (DELWP) used a hectare-based fuel-reduction target for public land, at 5 per cent, or 390,000 ha, to be burnt annually. The current aim is for a 70 per cent statewide residual risk target on 225,000 ha of public land.

Four main problems arise from overreliance on the use of this goal. Firstly, it is an arbitrary benchmark not necessarily based on what might be achieved with available resources or on what is acceptable. For example, before the Back Saturday 2009 bushfires, the residual risk was already below the 70 per cent figure. Secondly, it does not acknowledge the significant variations across the State. For example, the residual risk for Melbourne's fringes in 2019 was 83 per cent. Thirdly, concentrating on a statewide figure for residual risk for the purpose of fuel reduction can promote burning in areas with a low risk to life and property, such as remote forest areas, in order to achieve the arbitrary target. Such a policy is high cost but protects few people. It may leave high-risk areas relatively unprotected, such as on the fringes of Melbourne, where mixed landscapes of forest and housing make fuel-reduction burning difficult but where burning might benefit large populations at relatively lower costs.

Such a statewide strategy also ignores other potentially more effective methods of reducing risk particularly for areas with varying risk factors. Finally, imposing such a target overrides other natural values, such as threatened ecosystems and water catchments, and ignores evidence that it may change forest systems even to advantage fire-tolerant species and increase fire risk over the long term. The effectiveness of fuel-reduction burning falls as the FDI rises and is not effective above 100 FDI. The vast majority of bushfires occur under 90 FDI but catastrophic fires occur in conditions often well above 100 FDI. All such factors challenge the very purpose of fuel-reduction burning.

Worsening conditions and resulting catastrophic bushfires have triggered a long-overdue debate within government about the effectiveness of suppression tactics. Delayed responses to fire ignition have allowed bushfires to explode in scale and intensity until unable to be controlled, both in peri-urban, remote forested regions and on private land in rural areas. The 2019–2020 'Black Summer' Victorian bushfires, part of a series of fires in Eastern Australia, burnt for three months through public forest before being eventually halted only by reaching the ocean. New early detection methods including data analytics and communications, as well as the use of rapid response teams to extinguish fires by on-ground and aerial firefighting techniques, offer an alternative and potentially effective means of suppression (Yebra et al., 2022). More intensive aerial suppression and other techniques such as the use of buffer areas may also be needed to protect townships which have proved to be undefendable against catastrophic bushfires.

2.5 Liveability, Rural Amenity and Wellbeing

Risk and hazard are key factors in peri-urban liveability. The combination of amenity attractiveness and increasing risk is placing large numbers of people in dangerous locations (Reid et al., 2020). Peri-urban 'liveability' refers to "the ability of people to live in peri-urban areas, or the general quality of a place which makes it pleasant or agreeable for people to reside in" (Tract Consultants and Deloitte Access Economics, 2015, p. 17), and "represents the many characteristics that make a location a place where people want to live" (Victorian Competition and Efficiency Commission VCEC, 2008, p. xxv). Liveability can be defined in terms of objective features such as a temperate climate, affordable housing, infrastructure and safety. But for some it is best measured by citizen satisfaction, a subjective factor defined in terms of features such as connectiveness to family and friends, personal satisfaction and identity, and a sense of personal and community 'well-being' (Kubiszewski et al., 2019).

The ways variables interact are vitally important. Each element contributes to wellbeing but the interaction between elements can multiply impacts. Many peri-urban residents prioritise amenity factors such as rural and natural landscapes and socially cohesive communities, tolerating bushfire risk, lower-income levels, the lack of accessible employment and inadequate transport and health facilities for a chosen lifestyle. Even if residents accept poor physical infrastructure, usually they are less tolerant of health,

education and other social service failings. Major discrepancies in the provision of specialist and even general practitioner services still exist throughout Australian peri-urban areas. Valcarcel-Aguiar et al. (2019) have urged caution and the need to consider the temporal factors when assessing sustainable urban liveability. Residents, they argue, in practice may experience a temporary rise in the standard of liveability but often at the expense of serious environmental degradation.

In recent decades amenity has acted as a major factor in population movements to rural areas across the globe. Amenity refers to "agreeable ways or situations" or the attractiveness of a place and the benefits it affords inhabitants (Butt & Fish, 2016). Amenity also can be defined objectively in terms of physical conditions such as natural features, heritage buildings and infrastructure, and subjectively as personal perceptions, tolerance, diversity and safety. Regions with a range of amenity factors such as landscape, heritage architecture and access to metropolitan centres are particularly attractive to urban dwellers (Tonts & Horsley, 2019). The role of amenity is increasingly recognised as a significant factor in the process of new residents appropriating environmental attributes for their lifestyle benefits and consequently removing agricultural production from rural land (Argent et al., 2010; Mackay & Perkins, 2019). Migrants who move to rural areas for their amenity can be said to be consumers of perceived landscape and heritage values. Accessibility to urban services, quality of local services particularly health, education and employment, and land prices also are key influences on the growth of peri-urban and broader rural areas. But high amenity peri-urban and rural locations on the periphery of Melbourne and in rural Victoria, seemingly so attractive to potential residents seeking to experience high levels of 'liveability', are among the world's most vulnerable to catastrophic bushfire. Established perceptions of amenity, liveability and wellbeing can be completely transformed by catastrophic fire. Nothing changes resident perceptions of liveability as rapidly as beautiful and seemingly benign landscapes erupting into bushfires consuming everything in their paths.

Few investigations have been undertaken in Australia of resident perceptions of their local areas both before and after the devastation caused by a major bushfire event. Block et al. (2019) highlighted the deep emotional connection that survivors exhibited towards their chosen residential locations. This finding leaves unanswered the question of whether it is feasible for all to rebuild in the face of much higher insurance and building costs following more stringent bushfire-proofing regulations (de Vet &

Ericksen, 2020; Young et al., 2022) and the extent of varying resident resilience or abandonment of vulnerable locations. Further investigation is needed on this issue as well as more sophisticated research engagement with the amenity/liveability/wellbeing conceptual 'package' in impacted regions.

2.6 Rising Costs of Natural Disasters

When bushfires occur, risk is shared between a range of stakeholders, such as insurance companies, firefighters, households, private developers and governments. There is growing alarm in government and insurance circles at the escalating financial and other costs that are always incurred in the various phases of disaster response and recovery. The total economic costs can be very high (Stephenson et al., 2013). The 1967 'Black Tuesday' fires in Tasmania resulted in a record insurance payout for Australia. Some 1300 homes were destroyed and 62 lives lost in a fire that burnt approximately 3000 sq. kms. and came within 2 km of the Hobart CBD (Chambers & Brettingham-Moore, 1967). The Final Report into the 2009 Victorian 'Black Saturday' fires estimated their cost at a conservative $AUS4.4 billion. The calculation was based on a figure of $645 million for lives lost and $1.2 billion for successful insurance claims (Teague et al., 2010).

More recently, it has been calculated that by 2050 the economic cost of natural disasters in Australia will likely average AU$33 billion per year (Deloitte Access Economics, 2016). This may be an underestimate, especially in light of the recent modelling by Ademi et al. (2023) discussed above. By early 2023, a record $6 billion in insurance claims from Australian natural disasters had been settled for 2022. Some 50 per cent of these claims related to extreme rainfall and flooding in February and March 2022 alone, the most expensive Australian natural disaster yet recorded (Insurance Council of Australia, 2022a). Rising insurance costs from natural disasters are now affecting the price of all insurance premiums (Yeates, 2023). The international insurance industry has long recognised the interacting impacts of climate change and peri-urban development. Swiss Re (2018, p. 1), for example, commented that "the losses from the 2018 series of events highlight the increasing vulnerability of the ever-growing concentration of humans and property values on coastlines and in the urban-wildlife interface". Under a succession of neoliberal governments, one consequence has been a gradual shift towards placing the primary responsibility for disaster risk management on

individual households rather than on governments (Booth & Tranter, 2018; Bourobe et al., 2022). This trend is also evident in Canada and other OECD countries (Oulahen & Ventura, 2022).

Historically, the emphasis on the part of governments has always been on immediate response and relief rather than on the development of longer-term strategies centred around prevention of harm, resilience and future-proofing. Recent data have shown that over the period 2005–2022, Australia's federal government spent 97 per cent of bushfire-related funding on recovery at $(AU) 23.99 billion on disaster recovery and relief by comparison with a mere $(AU) 0.51 billion on resilience measures (Lefebvre & Reinhard, 2022). The Insurance Council of Australia (2022a) is one of a growing number of government and non-government agencies urging serious action on resilience investment.

In particular, through the international Sendai Framework Agreement, the Commonwealth government is under constant pressure to report real progress on resilience funding. The previous, Liberal-Coalition government promised to invest $4.8 billion on this but did not comply. With a change of government in late 2022, legislation was passed to establish a new 'Disaster Ready Fund'. From July 2023 it is planned that this will deliver up to $200 million a year to disaster mitigation projects. While certainly an advance on previous government commitments, there are still some serious questions to be asked, in particular, whether this level of funding is adequate in light of what is likely to unfold over coming decades, and how funding will be allocated to meet unfolding disaster resilience needs.

Our discussion now turns to a closer examination of the two main reasons for increased levels of bushfire risk: large-scale expansion of urban and rural-residential settlement into peri-urban areas, and climate change.

2.7 Expansion and New Patterns of Urban Settlement

Building on the earlier work of Blakeley and Carbonell (2012) and Norman (2022), we argue that little attention has been given in Australia to prevention of risk from bushfires and other natural hazards such as flooding and sea-level rise. In particular, policy- makers consistently have failed to use land use planning systems to reduce threats by limiting urban and rural-residential development particularly in high-risk peri-urban areas

(Gonzalez-Mathieson et al., 2021). This is evidence of major policy failure by all levels of government, and of the willingness of major interest groups such as the property development industry to ignore the risk from natural hazards to life and property. This chapter also demonstrates that a policy and management shift towards prevention of risk and adaptive resilience is gradually gaining support in Australia. It is unlikely that such change is beginning to arise in response to the findings of numerous official inquiries spanning over eighty years after major bushfire events and other natural disasters. More influential is the mounting evidence that contemporary fire-suppression and fuel management practices are proving inadequate in the new era of fire intensity and spatial impact (Lange & Gillespie, 2022).

The growing evidence of non-linear impacts particularly of climate change coupled with policies which have placed millions of people in areas of increasing risk is also beginning to force a radical rethink of land use policies and practices. Ironically, some visionary State governments in Victoria adopted precautionary land use policies aimed at the prevention of harm in the 25 years to 1992 before these were discarded by the dominance of neo-liberal governance. A model of governance based on reducing the traditional role of government has inevitably led to failures in using land use planning techniques to prevent or limit harm from natural disaster, and even in regulating potentially dangerous practices such as fire suppression and fuel management activities. The incremental and varying nature of attitudes and policy responses reinforce the observations of Susan Owens at the beginning of this chapter, particularly the theme of repeated conflict-oriented negotiation and re-evaluation of policy.

McGuirk and Argent (2011) and Argent and Plummer (2022) point to a dynamic new settlement pattern which has emerged relatively recently in Australia. Drawing on their analysis, this pattern can be characterised by three types of settlement: mixed township and rural settlement in peri-urban areas within 100 km of major city centres, similar settlement patterns beyond commuting distance of cities and concentrations of growth in high amenity areas. Buxton et al. (2011a) have identified four major peri-urban growth corridors emanating from Melbourne to the regional cities of Geelong, Ballarat, Bendigo and the Latrobe Valley. Regional cities encourage their own peri-urban development patterns resulting in growth expanding into other townships and rural areas threatening to form a linear pattern of urban and rural-residential growth along rail and road corridors.

Similar linear urban growth has developed over decades along the southern Victorian coastline and has proved especially vulnerable to devastating south-westerly wind changes which broaden northerly fire fronts, as during the Ash Wednesday 1983 fires. Population growth rates in peri-urban areas sometimes exceed those of capital cities. The recent COVID-19 pandemic has led to increased growth rates for regional centres as many people seek to relocate to rural and semi-rural locations in broader metropolitan regions and to work from home. Only time will tell if this is a permanent trend (Zenkteler et al., 2022). A substantial Australian population now lives in existing urban-edge localities which are among the most fire-prone in the world. Commonly in the international literature these are now referred to as WUI, or 'Wildland-Urban Interface' areas. In 2011, over 3.3 million people—or 25 per cent of Australia's metropolitan population—lived in 24 fast-growing local government areas on the edges of Australia's major cities (McGuirk & Argent, 2011) and a predicted population of 4.5 million there by 2021 (Australian Government, 2010) has been exceeded.

In recent decades, immigration has accounted for 60 per cent of Australia's population growth. Hugo's (2008) figure of 89 per cent of post-1996 migrants settling in capital cities has generally continued, most settling in Sydney and Melbourne. Over two-thirds of Australians live in capital cities and 75 per cent in major cities with populations over 100,000. Continued high growth rates in house prices have driven large numbers of new migrants and lower-income households to the outer fringes of major cities. The urban edges of many of these new suburban growth areas are susceptible to bushfire risk. The Sydney 2001–2002 bushfires and the 2009 Narre Warren and Bendigo fires in Victoria entered established urban areas, sometimes for considerable distances, resulting in the loss of over 100 Sydney and 53 Bendigo homes. Again, this reinforces Susan Owen's reference to unequal vulnerability to environmental hazard. The 2003 Canberra firestorm, destroying over 480 houses and killing 4 people, is the most notable example of a bushfire causing devastation in Australian suburban environments since the Hobart fire of 1967. As a planned city, Canberra adopted a clearly defined urban edge. Farmland seemed to present "a low fire risk", and "the fact that no urban houses had been lost to bushfire since 1952 had given rise to a belief that the houses of suburban Canberra were not vulnerable" (McLeod, 2003, p. 172). More recently, bushfires have been encroaching onto land with little or no history of fire risk. The combination of relatively cheap housing, amenity

attractiveness and increasing natural hazard risk is placing large numbers of people in dangerous situations especially in peri-urban localities.

If the more likely recent national and international climate scenarios eventuate, this failure of anticipatory policy may lead to widespread abandonment of peri-urban rural-residential properties and a heightened risk to peri-urban townships and fringe urban suburbs. The 2009 Victorian Bushfires Royal Commission argued that the bushfire risk is so high in some areas that development should be restricted, and that "even a combination of protective measures might not be enough to reduce the risk to an acceptable level" in such locations. Ultimately, the government should "implement a retreat and resettlement strategy for existing developments in areas of unacceptably high bushfire risk, including a scheme for non-compulsory acquisition by the State of land in these areas" (Teague et al., 2010, p. 252).

Every Australian State now experiences major bushfires, including cool temperate, tropical and subtropical areas and coastal areas of New South Wales. The 1983 'Ash Wednesday' fires resulted in 47 deaths and the loss of over 2000 properties in Victoria, and 28 deaths and the loss of over 380 homes in South Australia. In the 2009 'Black Saturday' fires on the periphery of Melbourne, 173 lives were lost, over 3500 buildings were destroyed and 414 people were injured. The 2009 bushfires ranked as Australia's most serious civilian tragedy and one of the world's ten most deadly recorded bushfires (Teague et al., 2010). A number of townships were destroyed, including Marysville and Kinglake, but a significant feature was the devastation of a large area of rural land in Melbourne's broader peri-urban area (Fisher, 2012).

The 2019–2020 fire season extended across Australia burning some 18.5 million hectares, destroying over 3500 houses, killing 34 people and leading to insurance losses of over $1.3 billion (Centre for Disaster Philanthropy, 2020). Almost three billion animals were also killed or displaced (World Wildlife Fund for Nature, 2020). For comparison, these fires were almost twice the size of the 2009 fires. In Eastern Australia, they burnt an almost continuous 1160 km band from sub-tropical South Eastern Queensland to South Eastern Victoria across an area of over 7 million hectares of which 5.7 million hectares of forest and woodland burnt (Bushfire Recovery Project, 2021).

In all these cases, in the recovery phase, there is always the question whether rebuilding in the same locations is an advisable response. Disasters provide opportunities to rethink settlement policies and the evidence from

previous disasters is that rebuilding has not always succeeded. Some areas never recover economically (Blakeley & Fisher, 2017; Chang et al., 2022). Voluntary and/or compulsory acquisition of individual blocks deemed especially vulnerable to bushfire risk is highly controversial in Australia, clashing as it does with deeply entrenched views on private property rights. The policy has been implemented from time to time but generally only sparingly, and in a poorly resourced, ad hoc manner. The most notable successful example was in Victoria for 25 years until 1992 as shown below. The Royal Commission that investigated the catastrophic 2009 fires in Victoria made 67 recommendations. All were accepted by the government of the day with only one exception, that proposing the voluntary buyback of at-risk properties (Teague et al., 2010). A limited $60 million buyback scheme was later adopted.

2.8 Peri-Urban/Interface Areas

The paradox of peri-urban, or 'exurban' or 'wildland-urban interface' (WUI) (Johnston et al., 2020) settlement is that as large numbers of people move to fringe urban areas they threaten to transform the features which attracted them. Peri-urban development can increase vulnerability to natural hazards by placing significant populations in high-risk locations susceptible to extreme events. The potential nature and scale of such risks are so serious that they threaten to make extensive peri-urban areas uninhabitable.

Despite wide socio-economic diversity, peri-urban residents most vulnerable to natural disasters are low-income, transport-poor households who experience relatively low standards of infrastructure and services (McDougall & Maharaj, 2011). When linking the mounting economic costs of natural disasters in Australia to the concept of 'disaster justice', Lukasiewicz (2020) reinforces the argument of Handmer et al. (2018) that rising levels of risk largely are the result of "population growth, rather than a growth in the number of natural hazards, suggesting that Australia's disaster risk is driven by socio-economic trends". Ulubasoglu's (2020) longitudinal analysis of Australian natural disasters has highlighted the degree to which they exacerbate inequality. The Royal Commission established in the aftermath of the 2009 bushfires in Victoria noted that 44 per cent of the 173 deceased people could be classified as 'vulnerable' (Teague et al., 2010).

The multiple functions of peri-urban regions reinforce the complexity of their intersecting sectoral values and impacts. Most cities have been constructed on, or close to, coastal or riverine sites, usually on productive soils and in environmentally significant areas. These locations and the range of existing and proposed land uses have led to peri-urban regions being regarded as some of the world's most contested areas (Dadashpoor & Ahani, 2019). The prioritising of natural amenity frequently conflicts with traditional productive practices such as agriculture (Spataru et al., 2020) and with attempts to transform rural landscapes into residential or rural-residential subdivisions.

Central to this discussion are powerful political and economic drivers for increasing population and dwelling numbers in peri-urban locations. Large mega-regions centred on such cities as Melbourne remain attractive for their potential employment and educational opportunities. One consequence is that for these cities the cheapest housing is often found on the city fringes. A powerful driver is the strong financial incentives for fragmented State and local government entities to encourage population growth and dwelling construction, an orientation underpinned by neoliberal governance structures, short-term policy horizons and a 'growth impulse' (Hatch, 2022; Wright, 2023). In Australia, growth allows subnational governments to benefit from stamp duty and local rate taxes and to lobby for greater funding from national coffers for infrastructure and services. Development and infrastructure companies continue to successfully lobby for subdivision at the urban edge. But low-density built form in peri-urban areas creates perfect conditions for heightened bushfire vulnerability (McDermott & Holdsworth, 2017).

2.9 Planning Systems and Risk Reduction

Many research projects have outlined scenarios which illustrate how climate change might affect settlements and natural systems but relatively few have quantified the ways hazardous events might affect the liveability and resilience of communities (Handmer et al., 2013, O'Neill & Handmer, 2012). Renaud and Perez (2010) argue that the complexity of interacting social and ecological factors makes the identification of 'tipping points', where the resilience of communities to change is overwhelmed, difficult to determine. Since 2008, however, some Australian studies have sought to define the features of a 'climate resilient community'. Stanley et al. (2013), for example, examined historical cases of extreme climatic events or

conditions to examine their impacts and sought to identify the characteristics of a climate-adapted settlement. Alberti and Marzluff (2004) argued that resilience should be understood in terms of dynamic interactions between socio-economic and biophysical processes operating over multiple scales.

As noted earlier, considerable emphasis in Victoria has been placed on fuel management as the primary tool for reducing bushfire risk. However, fuel management is related to risk as a consequence of hazard whereas a more effective means of increasing the resilience of communities by managing climate-induced risk is through anticipating the likelihood of harm. The most effective means of anticipating risk to prevent or limit harm is the use of land use planning systems. Yet, no Commonwealth or State government and few local government jurisdictions have developed effective controls over land use and development as a means of protecting life and property.

The two main land use elements contributing to bushfire risk are existing rural land fragmentation where large numbers of small rural lots exist often without dwellings, and new residential and rural-residential subdivision in rural areas particularly on the city edges and fringes of rural towns. One study (Buxton et al., 2011a) showed that over 52,000 primarily small rural lots without dwellings exist in the rural areas of just five peri-urban Melbourne municipalities. Extensive further subdivision can occur. In the ten years to 2009, over 4000 houses were built in the rural zones of these five peri-urban councils, with the same building rate continuing after the 2009 bushfires. Large numbers of dwellings destroyed in the 2009 fires were constructed relatively recently in the Rural Living Zone, with 37 per cent of fire affected lots sized 2 hectares or less (Llausàs et al., 2016).

The extensive 2019–2020 Australian bush fires demonstrated that dispersed houses on rural-residential lots and residential pockets on the fringes of townships in rural balance areas are at greatest risk from catastrophic bushfire. Earlier reports (Miller et al., 1984; New South Wales Joint Select Committee on Bushfires, 2002; Ellis et al., 2004) have reinforced the argument that the proliferation of small rural-residential lots outside townships and the boundaries to cities has placed large numbers of Australian residents in areas of high risk. The 2009 Bushfires Royal Commission also devoted considerable attention to the potential danger from the proliferation of small lots in rural landscapes and around major cities and towns. It considered the possible impacts of future fires on increased regional and rural populations arguing that it is vital that regional

planning "deals with bushfire risk management—in particular, in the context of small undeveloped rural lots and the urban growth of Victoria's regional cities". Development of many rural lots "scattered across the landscape has the potential to greatly increase bushfire risk, especially if the blocks are too small to create defendable space around dwellings" (Teague et al., 2010, p. 13).

Land use planning is the key policy instrument able to prevent further dwelling construction in bushfire-prone areas. A series of reports following the 1983 Australian Ash Wednesday bushfires promoted the need for techniques such as zoning, subdivision design, minimum lot-sizes and siting of buildings to reduce risk (Miller et al., 1984). More recently, the Bushfire CRC (Norman et al., 2014) investigated 16 major bushfire inquiries from the 1939 Royal Commission in Victoria to the 2011 report into Western Australian bushfires. The inquiry into the 1967 Tasmanian bushfires (Chambers & Brettingham-Moore, 1967) identified two issues of significant concern in future bushfire inquiry reports: "[T]he expansion of the rural/urban interface and the fact that major bushfires could enter far into the suburbs, well beyond the urban edge … [destroying] … buildings on the fringes of urban development … [and] … in high density suburbs" (Norman et al., 2014, p. 47). Other inquiries have continued this emphasis on the potential for planning to anticipate and prevent risk. The 2004 National Inquiry on Bushfire Mitigation and Management referred to land use planning as "the single most important mitigation measure in preventing future disaster losses in areas of new development" (Ellis et al., 2004, p. 57).

The 2009 Bushfires Royal Commission devoted an entire section to planning and was the first Australian report to consider the vulnerability of such small rural lots to bushfires. The Commission's view was that bushfire risk is best managed by "concentrating urban and semi-rural settlements in defined areas with adequate buffers, good road access, emergency services and fire refuges … dealt with in a regional settlement policy". This meant that planning should "reduce bushfire risk by, among other things, restricting development in the areas of highest risk, where people's lives may be gravely endangered in the event of extreme bushfire" (Teague et al., 2010, p. 252). The Commission listed a number of possible techniques: land swaps, minimum lot sizes for dwellings, restructured lots, tenement controls and transfer or purchase of development rights. It favoured strengthening of existing zones and planning controls, and the use of minimum lot sizes for subdivision and dwellings in rural areas.

One study of several outer peri-urban Victorian councils (Buxton et al., 2014) modelled two techniques in scenarios to reduce rural dwelling construction on existing lots: the use of a minimum lot size and a tenement control. A minimum lot size entitlement prevents dwellings and other structures being built on any lot below a nominated size, such as 40 hectares. A tenement control is a land use mechanism which applies only to multiple lots held in single ownership. It binds together multiple lots owned by one person to reduce multiple land development entitlements, such as for dwellings, to one. These techniques are effective means of preventing the proliferation of dwellings and other structures across rural landscapes. Applying a minimum lot size of 40 hectares in the *Farming and Rural Conservation Zones* and 16 hectares in the *Rural Living Zone* reduced the number of potential new dwellings from 49,449 to 10,657. A tenement control would not restrict dwelling construction on the 32,896 singly owned lots but would reduce significantly the development potential of the multiple lots held in single ownerships. When applied to the 46,179 multiple lots on the 10,196 properties comprising combinations of lots, potential dwellings fell under a 40 hectare tenement control to 7395 dwellings.

With each major bushfire event there is a growing, though patchy, acceptance of the need to take account of the fire hazard through stronger land use planning regulations and practices. The period, 1997–2008, for example, saw the introduction of the *Wildfire Management Overlay (WMO)* in the Victoria Planning Provisions. Where land use systems are used, governments generally have concentrated on regulating dwelling standards and ignored the need to prevent dwelling construction. For example, in Victoria, regulation after the 2009 fires concentrated on increasing the potential for dwellings to survive bushfire through higher construction standards and maintaining 'defendable space' around dwellings. The 2009 Victorian Bushfires Royal Commission made 19 recommendations for improved building and planning controls. As a result, the government declared most of the State outside metropolitan areas a *Bushfire Protection Area* (BPA) requiring permit control for new buildings governed by the *Bushfire Management Overlay (BMO)* and for construction according to *Bushfire Attack Level (BAL) 12.5* under the Australian standard for construction of buildings in bushfire prone areas *AS 3959-2009*. No bushfire risk mitigation measures are required for existing dwellings.

However, these initiatives continue to face major hurdles. As outlined by Gonzalez-Mathieson et al. (2019, p. 65), "The urban footprint has largely been determined by development that occurred prior to bushfire regulation. … Local governments that are responsible for the bulk of implementation are often overworked and under resourced for this role". In assessing whether a permit should be granted to construct a building, a local council evaluates compliance of a Bushfire Management Statement to decide whether risk can be mitigated to an acceptable level. This typically includes a bushfire hazard site assessment, bushfire hazard landscape assessment and use of BMO compliance section based on elements including BAL construction standard (such as building design and type of building materials), defendable space, slope of land, vegetation type and density, location of the building in relation to vegetation, provision of a water supply for firefighting and access and egress for occupants and emergency services. However, problems arise with such assessments of bushfire risk. The likelihood that the proposal will comply with the statutory requirement for hazard assessment does not guarantee survival of life or property. The notion of appropriate location is a more fundamental means of addressing a broader concept of risk by preventing harm. This requires anticipatory policy and practice.

A specific clause in all Victorian planning schemes, Clause 13.02-1 s, addresses broader considerations of risk, uncertainty, anticipation and precaution by: giving priority to the protection of human life; directing population growth and development to low-risk locations; ensuring that the bushfire risk to existing and future residents, property and infrastructure will not increase as a result of future land use and development; and assessing alternative low-risk locations for settlement growth. However, this clause is often ignored in assessing building compliance. An additional problem has been highlighted by McDonald and McCormack (2022). It relates to the obligations that are frequently imposed on existing landowners by local government authorities to mitigate fire-risk through fuel reduction and the construction of fire-breaks. Such responsibilities may fall on absentee landowners and are rarely enforced. They argue that the effectiveness of such policies to achieve the desired aim of fire-mitigation needs closer attention.

Having considered the first main contributor to increased risk from natural disasters such as bushfire, that is, large-scale expansion of urban and rural-residential settlement into peri-urban areas, the chapter now turns to the second contributor, changing environmental conditions, principally climate change.

2.10 Climate Change and Increased Risk

The link between climate change and the increased threat from bushfires was first signalled in Australia as far back as the 1980s (Beer et al., 1988). Since then, the supportive evidence has been growing steadily and is now largely unquestioned in the scientific community. History demonstrates that scientific arguments do not always influence negotiations over environmental issues, especially when faced with ongoing opposition and dogged denialism from powerful, political and commercial interests (Nyberg et al., 2022).

As noted, major bushfire events cannot be treated in isolation but often occur after periods of extended drought and have widespread social, economic and political ramifications. Growing attention is being focused on assemblages of consecutive disasters that may operate at wide-ranging temporal and spatial scales (de Ruiter et al., 2020; Kreibich et al., 2022). Alexandra and Finlayson (2020), for example, have reminded us that bushfires leave a legacy of scorched areas highly susceptible to soil erosion, flooding and water contamination following torrential rain. The nexus between energy, water and the fire hazard became clear in Victoria in 2019 when it was deemed necessary to purchase large quantities of clean water from the State's, Wonthaggi desalination plant to compensate for unusable, contaminated water in the State's seriously, fire-impacted catchments. The decision to build the plant in the first place was made by the State government at the height of the Millennium drought in June 2007. It was completed in December 2012, but was controversial from the start. Critics highlighted the inappropriate site location, the energy costs associated with desalination and the ongoing financial impost on the State. The overseas plant owners—Aquasure—receive $608 million a year, even if no water is delivered (ABC News, 2012).

The World Meteorological Organization (2020) report on the world's climate found that the five years between 2014 and 2019 were the warmest on record. The Intergovernmental Panel on Climate Change (IPCC, 2018) noted that current pledges to cut CO_2 emissions will push global warming to 3 °C by 2100. Every 10 years for the 40 years to 2010 the south-eastern Australian coast has experienced a mean temperature increase of 0.1–0.3 °C, 2.5 more days above 35 °C and a strong drying trend of 30–50 mm per decade (Spratt & Armistead, 2020). For Australia and Oceania, 2019 was both the warmest and the driest year on record, while 2021 and 2022 saw record-breaking heatwaves in western North

America and the UK (Climate Council of Australia, 2022; Filkov et al., 2020).

The 2022 State of the Climate report (CSIRO, BOM, 2022) found that Australia's climate has warmed on average by 1.47 °C since national records began in 1910. The eight years from 2013 to 2020 are all among the ten warmest ever measured and 2019 was Australia's warmest on record. Since the 1950s, extreme fire weather has increased and the fire season has lengthened across much of the country resulting in more extensive, intense and frequent fires, especially in southern Australia. Despite the relatively high rainfall in south-eastern Australia from 2020 to 2022, April to October rainfall has fallen by 10 per cent since the late 1990s. This has led to reduced streamflow with 60 per cent of Australian water gauges showing a declining trend. Yet heavy rainfall events are becoming more intense.

The CSIRO and Bureau of Meteorology (2019) have produced new regional climate change projections for Australia based on data from up to 40 global climate models, using 21 climate variables for four 20-year time periods to 2090. There is strong confidence that in south-eastern Australia high-temperature days will become more frequent and hotter, winter and spring rainfall will decrease and the period in drought will increase leading to decreased soil moisture. The *State of Climate Report 2018* (CSIRO and Bureau of Meteorology, 2018) identified a decline of around 11 per cent in the April–October rainfall in the southeast of Australia since the late 1990s. Both reports warned of a long-term increase in extreme fire weather measured in frequency and severity, and in the length of the fire season. More recently, using a now well-established methodology for conducting extreme event attribution research, the World Weather Attribution (WWA) consortium has produced the first detailed analysis to quantify the influence of climate change on the 2019/2020 bushfires in south-eastern Australia. The conclusion of the study was that climate change boosted the bushfire threat by at least 30 per cent (van Oldenbourgh et al., 2021; Jones et al., 2022).

The 2009 Victorian Bushfires Royal Commission proposed that criteria identifying risk consider the "potential effects of climate change on the bushfire hazard in the area" (Teague et al., 2010, p. 226). Soon after, the Western Australian Inquiry into the 2011 Perth bushfires argued that "recognition should be given to the changes in climate that might require a new approach to prevention against bushfires … there must be a limit to the time that it has taken for governments at the State and Local level to

act upon the reality of climate change and reflect this reality in town planning and building approvals" (Keelty, 2011, pp. 11–12). Following this, Steffen et al. (2015, 2018) added increasingly alarmist scientific weight to the climate change/bushfire debate.

2.11 Extreme Weather Events

Driven by accelerating climate change, extreme weather events are becoming more common around the world. In the period 2001–2020, the global average for the number of recorded events such as droughts, floods, cyclones, heatwaves and severe bushfire seasons was 357. For 2021—dominated by floods—that number had grown to 432 (Lefebvre & Reinhard, 2022). Increasingly, too, these are turning into 'disasters' for directly impacted individuals and enterprises but also more widely for governments, finance institutions, global trade and natural ecosystems (Alexandra, 2020; *The Lancet*, 2022). Australia has always been especially vulnerable to such events. In particular, together with the western United States, it is one of the world's most fire-prone regions as well as being subject to increasingly serious health-related impacts (Arriagada et al., 2020). The impact of extreme weather events in Australia is such at an estimated 22,000 Australians move home annually because of extreme weather events, a figure expected to rise to 38,000 annually by 2071 (Bernard et al., 2024).

Science has provided clear evidence of the vital importance of temperature changes in the oceans to our understanding of climate oscillations and their role in providing ideal conditions for wide-scale heat events and bush fires. Such changes have triggered at least two significant periods of long-term drought in Australia. These were the 1896–1905 'Federation Drought' and the 1996–2020 'Millennium Drought'. The latter provided perfect conditions for the outbreak of major fires. By the end of 2019 every State was alight and commentators at the time were judging this "by far Australia's costliest disaster" (Read & Denniss, 2020).

More recent ocean temperature variations—the La Nina phenomenon—delivered unprecedented rainfall totals and associated flooding events across eastern Australia and an equally serious drought in the western United States in 2021/2022. Under La Nina conditions excessive heat accumulates in the tropical Pacific. In 2022, Australia remained in the grip of a three-year, La Nina weather event. Since 1900, 30 La Nina years have affected Australia but none have produced rainfall totals rivalling

those of 2021/2022. Global warming is hastening moisture build-up in the atmosphere. Every 1 °C increase delivers an additional 7 per cent moisture content. When the costs from flooding are finally calculated, the 2021/2022 episode will surpass those from the 2019/2020 bushfires.

By contrast, El Nino is characterised by a one- to two-year warming period in the Eastern equatorial Pacific. El Nino events are becoming more common and are often associated with serious drought conditions and widespread forest fires in many countries. Notable El Nino years were 1982–1983, 1997 and 2015. Both La Nina and El Nino phenomena are occurring against a background of accelerating global warming that is resulting in an increasing number of regions—including the Arctic—joining the growing list of fire-prone areas (Bronnimann, 2018). The trend is for fire seasons to start earlier, to last longer and for the fires to be more intense. For example, the devastating 'Black Saturday' bushfire of 7 February 2009 in Victoria followed a 12-year El Nino episode and associated drought. Climate change is increasingly recognised as being responsible for other associated weather events in the form of intense hail, wind and rainstorms. In January and February 2020, Sydney recorded its highest four-day rainfall total in 30 years and 37,000 insurance claims for hailstorm and wind damage in the Canberra region (Climate Council of Australia, 2020).

As displayed routinely on satellite imagery, most fires in Australia are regularly occurring 'natural' events triggered by lightning strikes over extensive areas of inland, central and northern Australia. They have always been a fundamental feature of the Australian landscape and over millennia the country's vegetation has evolved to co-exist with, and even become dependent upon fire (Griffiths, 2001). Such fires usually begin far from existing towns or critical infrastructure and so do not readily warrant being labelled 'hazards' or 'disasters'. However, the 2021/2022 bushfires showed that unless extinguished quickly at source, these fires in times of climate change potentially can burn through extensive forested areas to reach settled areas with catastrophic results. Equally importantly, some 65,000 years of Indigenous settlement produced what can now be seen as sophisticated land-management practices involving 'firestick' cool burns at certain times of the year to prevent large-scale, catastrophic fires (Bardsley et al., 2019; Fletcher et al., 2021). Quantitative evidence from long-sequence pollen cores has highlighted the extent to which British colonisation disrupted traditional Indigenous fire-management practices, impacted fuel accumulation and structure and preconditioned many parts

of the country for larger-scale and more intense wildfire occurrences (Mariani et al., 2022).

Climate change has reinforced the importance of understanding the relationships between variables in a functioning system. Preventing dwelling construction in vulnerable areas, for example, lessens the destructive impacts of worsening bushfires. In other ways, human interventions have exacerbated the fire danger. The *Forest Act* (1958) in Victoria mandates fire suppression and fuel-reduction burning, practices largely designed to protect settlements and critical infrastructure. These have proved largely ineffective in preventing catastrophic bushfires under extreme weather conditions (Laming et al., 2022). Despite disputed studies, evidence supports the conclusion that logging and 'thinning' native eucalypt forests leads to increased severity of bushfires in more flammable forests. Lindenmayer et al. (2021) reviewed the data and findings of 51 peer-reviewed studies to assess the impacts of logging on bushfires. Logging removed the canopy, allowing the entry of the sun and wind as drying agents, while post-logging debris and dense regrowth increased fuel loads. Similarly, 'mechanical thinning' reduced the surface fuel but increased coarse woody debris by 50 per cent and increased the density of saplings tenfold. A clear relationship was evident between fire severity and logged forest in 2009 after Black Saturday fires (Price & Bradstock, 2012; Taylor et al., 2014; Attiwill et al., 2014), while the Murrindindi-Kilmore element of these fires slowed when it entered old growth forest in 2009 (Cruz et al., 2012).

Abram et al. (2021) and Lindenmayer et al. (2021) reinforced the findings of Mackey et al. (2021) that climate change was the key contributor to more severe bushfires, resulting in fires in the 2019–2020 spring and summer bushfires in eastern and south-eastern Australia that were unprecedented in terms of their geographic location, spatial extent, severity and the forest types burnt. These fires were worsened by extreme weather conditions including winter drought and high spring and summer temperatures. These researchers concluded that mega-fires present a new category of hazard that requires another approach to bushfire risk management in Australia.

2.12 Increasing Flood Incidence

The interconnections between the likelihood of events and a range of consequences, together with the complexity of rapid shifts between climate extremes, are placing greater emphasis on the need to analyse the interactions between physical and human systems. The uncertainty from difficulties in allowing for all future conditions is leading some researchers to question risk and impact assessments developed traditionally through scenarios. This suggests the need to alter the way risk is interpreted and managed towards understanding "compounding climate extremes".

These involve multiple climate hazard events occurring at the same time in the same or connected locations, or multiple climate extremes occurring in succession. The severe drought of 2017–2019, followed by devastating bushfires of 2019–2020, then three consecutive flooding years due to La Niña together provide one example (Vogel, 2022). Zscheischler et al. (2018) advocate a shift from impact analysis to vulnerability analysis, where impact analysis examines the impact of a single hazard on multiple consequences but vulnerability analysis concentrates on the multiple causes of single outcomes. Understanding how a confluence of climate hazards could influence the system can then assist in realising the likelihood of such occurrences. The ways urbanisation and changing land uses worsen the impacts of extreme flooding illustrate further the need to examine all interacting and complex social and ecological elements. The impacts from extreme floods are worsened by human settlement and land uses on flood plains. From Australian colonial times, large numbers of towns and individual structures were constructed on flood plains often close to river banks (Cook et al., 2022).

A 'flood' is any stream flow which greatly exceeds the average. A 'flood plain' is land outside a stream channel described by the perimeter of the maximum limiting flood (White, 1942). New South Wales Governor Arthur Phillip warned colonists in 1789 about the dangers of flooding in the Hawkesbury and Nepean rivers near Sydney. Governor Lachlan Macquarie repeatedly issued the same warning, stating in 1817 that

> many of the Deplorable Losses which have been sustained within the last few years at least, might have been in great measure averted had the settlers paid due consideration to their own interests, and to the frequent Admonitions they had received by removing their Residences from within the Flood Marks to the Townships assigned for them on the High Lands. …

> Those who, not withstanding, shall perversely neglect the present Admonition and Exhortation to their own Benefit, must be considered wilfully and obstinately blind to their true Interests and must be considered undeserving any future indulgences. (Macquarie, 1817)

Both Governors were ignored. In 2022, 70,000 people now live in 12,000 dwellings sited in the 40,000 hectare Hawkesbury-Nepean floodplain and the NSW government plans to increase that number to 130,000 by 2050 (Insurance Council of Australia, 2022b).

From 22 February to 9 March 2022, three weather systems in Eastern Australia brought unprecedented rainfall to about 600 kilometres of coastline, resulting in catastrophic flooding to more than 70 local government areas in Queensland and New South Wales. Flooding in the Northern Rivers region particularly affected towns such as Lismore (shown in Fig. 2.1), and in South East Queensland particularly affected Brisbane.

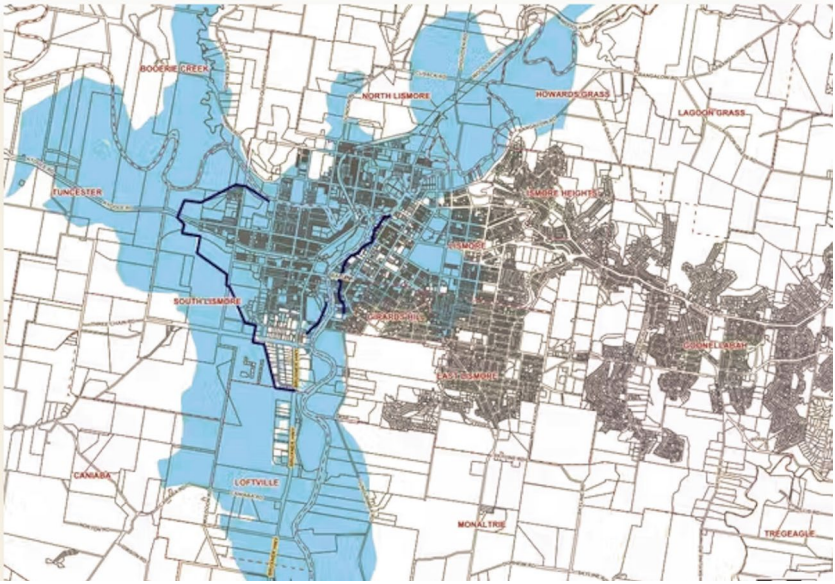

Fig. 2.1 Flooding in Lismore, New South Wales. (Source: Lismore City Council 2023—Lismore Development Control Plan Flood Prone Lands. Light blue areas lie in a 1:100-year (1% annual chance) flood plain; the dark blue line shows levies)

The flood affecting Lismore was the worst on record, at 14.39 m on 28 February 2022, and rainfall levels similarly exceeded all records (Callaghan, 2023). The Brisbane River rose four metres above normal and over 140 suburbs around Brisbane were placed under evacuation orders (Insurance Council of Australia, 2022a). This repeated the impacts of the 2010–2011 flood which inundated 22,696 Brisbane properties (Wenger, 2014).

Catastrophic rainfall reached Victoria in the latter months of 2022, affected by the negative Indian Ocean dipole (IOD) which occurred in two consecutive years for the first time since reliable records began in 1960. Unusually, low pressure weather systems moved east, replicating the severe weather systems along the New South Wales coast, and warm water concentrated in the eastern Indian Ocean leading to moisture-rich air flows towards Australia. The result was extensive flooding in many Victorian water systems flowing north towards the Murray River. The extensive flat riverine plain resulted in broad areas being inundated for long periods, flooding many towns. Rural areas were also adversely affected as about 500,000 hectares of farmland was flooded leading to extensive crop and infrastructure losses and 14,000 head of livestock lost.

Australia is famously a "land of drought and flooding rains". Historically, three periods display rainfall and flood patterns similar to the February 2022 events for the coastal river catchments extending from the Brisbane River to the southern New South Wales border: from January 1892 to February 1895 at 4.21 major flood events a year; July 1949 to February 1956 at 3.15 events a year; and from April 1973 to June 1976 at 4.11 a year. Unprecedented El Nino events from June 1976 are often described as a climate shift (Speer, 2008; Callaghan, 2021). The National Emergency Management Agency states that "Australia is experiencing an increase in the frequency, severity, and impact of climate change-influenced disasters" (Senate Select Committee, 2024, p. 3). Power and Callaghan (2016) point to an increasing trend in major flooding evident in these coastal regions. Serious flooding is occurring in many other regions. For example, 80 per cent of Queensland was declared a disaster zone from flooding in 2010–2011. Cumulative damage from repeated floods is now threatening the survival of many communities. Recently, catastrophic flooding has occurred year-on-year and sometimes several times a year. In the 18 months to July 2022, four floods affected the town of Windsor in the Hawkesbury-Nepean valley to a height of 14 m (see Fig. 2.2). Even Brisbane, the capital of Queensland, built on a river edge, was affected by serious flooding in 2011, 2013, 2022 (Cook, 2019).

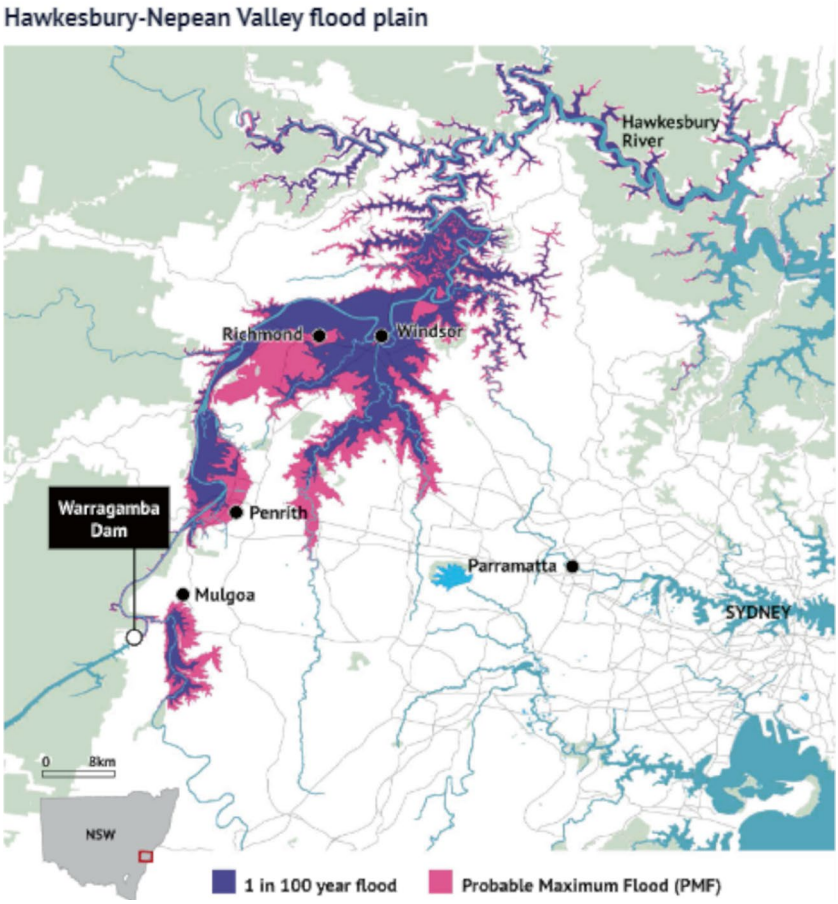

Fig. 2.2 Western Sydney flood plain. (Source: Infrastructure New South Wales Hawkesbury-Nepean Valley Flood Risk Management Strategy 2021)

Ford et al. (2019, p. 2030) comment that "many studies (such as Schreider et al., 2000) have examined the effects of climate change on urban flooding impacts, demonstrating that changes to rainfall extremes will increase the magnitude and frequency of flood events". They provide a multi-scale urban-integrated assessment framework for assessing the impacts of climate change on flooding in urban areas, relating future population and land-use scenario to flood risk under climate change. This kind

of analysis is one example of a methodology which evaluates the future risk from urban development scenarios. Perceptions by governments, institutions and citizens are influencing responses directed particularly to the climate change impacts on urban areas, the adequacy of infrastructure and the issue of flood insurance. The scale of the problem coupled with extreme weather events has led to debate on the need to prevent further urbanisation and dwelling construction on flood plains and even to the relocation of communities. Between 2 and 3 per cent of Australian homes now lie in frequent flood zones and 15 per cent are susceptible to flooding (Insurance Council of Australia, 2022a). An estimated million homes nationwide in 30 priority local government areas will be subject to high risk of devastating riverine flooding by 2030 without investment in adaptation and mitigation causing $170 billion in property value losses by 2050 (Climate Valuation, 2022; Redman, 2022).

Solutions proposed to the problems caused by more frequent and intense flooding have included a range of measures from stronger preventive land use controls to engineering solutions and relocation. On 14 March 2022, during some of the worst flooding, New South Wales Planning Minister Anthony Roberts revoked a requirement that had been introduced by his predecessor Robert Stokes outlining nine principles for sustainable development, including managing the risks of climate change, risk-management and resilience-building. Roberts was implementing "a clear set of priorities to deliver a pipeline of new housing supply and act on housing affordability" set by Premier Dominic Perrottet (Power, 2022, p. 2).

However, in response to criticism, Perrottet subsequently established an inquiry to investigate the causes of the recent deadly floods, and the emergency response including the future of building on floodplains. The National Recovery Resilience Agency head, Shane Stone, in early March 2022 urged an end to all floodplain development and stated that houses inundated in floods should not be rebuilt. Federal Emergency Management Minister, Murray Watt, also stated that new laws were urgently needed to stop houses being built in high-risk flood plains and bushfire zones and that current planning systems were inadequate given escalating natural disasters driven by climate change. "We must think more seriously about climate and disaster risk when planning future housing development", Watt said. "It makes absolutely no sense for all levels of government to spend billions in disaster recovery while we continue to see housing built on floodplains" (Koziol et al., 2022). Other studies have reinforced this

conclusion. For example, the Commonwealth government parliamentary floods enquiry report into insurer responses to 2022 major floods recommended that all development cease in areas affected by a 1–100 flood risk or greater and that building approvals take account of future climate change (House of Representatives, 2024).

Governments also are investigating engineering solutions, particularly raising the height of dam walls and flood levy banks. Following the release of its 2017, *Hawkesbury-Nepean Flood Risk Management Strategy*, the NSW Government on 5 October 2022 declared a proposal to raise the Warragamba Dam wall by 14 metres as critical to the state and began an inquiry into the proposal. Modelling by Infrastructure New South Wales in March 2021 found that a raised wall for Warragamba Dam, one of Sydney's main water supply sources, would reduce flood levels at Penrith and Windsor, major towns in the Macquarie-Nepean system, by 5.3 metres and 3.4 metres, respectively (Koziol et al., 2022). However, such a development, were it to proceed, would have a major impact on many significant Aboriginal heritage sites. Raising the Wivenhoe dam wall which protects Brisbane has also been proposed. However, others have criticised this and similar solutions. The Insurance Council of Australia (2022c), for example, has opposed the plan and claimed that some costs and benefits of alternative proposals were minimised.

Gilbert White (1942) and Macdonald et al. (2012) famously said that floods are acts of God but that because of human encroachment upon the flood plains of rivers, flood losses are largely acts of man. White described the main engineering works as levees, channel straightening and diversions, and dams. Engineering solutions can add to the scale of disasters, leading to the need to rapidly release impounded water and increasing the severity of inundation in some places while preventing it in others. Levees and dams have often led directly to further development in flood plains, worsening the devastation from extreme weather events. Ecosystem approaches, in contrast, allow rivers to spread over wider areas and restore natural waterway systems to slow rivers and progressively feed large volumes of water into their lower reaches (Nordenson et al., 2018; Rugendyke & Vanclay, 2022). Restoration may also require re-engineering natural river systems, but few examples are evident in Australia.

The increasing severity and frequency of floods and wildfires, not anticipation of such events, is beginning to promote policy change. Cook and Werner (2022) argue that abandonment of floodplains is inevitable. Bates et al. (2008) have shown that traditional estimates of frequency may no

longer suffice, and that 1:100 floods in the Murray River, for example, may occur as often as every 10 years by the late twenty-first century. Inadequate mapping or definitions of flood events can lead to further development subjected to flooding. The relevant Victorian government Practice Note, for example, applies a 1:100 flood level to land subject to inundation at a Design Flood not a Probable Maximum Flood Level.

While New Zealand clearly leads the way with its managed retreat legislation (Hanna et al., 2022), Australian governments are slowly beginning to develop integrated disaster management policies based on the principles of preparation, response and recovery. Such policies now include such measures as raising the height, retrofitting and purchasing flood-affected properties. Property purchase seems to be the most cost-effective action for repetitively flooded properties (NWF, 1998). Cost benefit analysis after the 1993 Mississippi floods showed that cumulative damage costs were up to seven times the value of the original properties (Wenger, 2014). Australian governments have used a number of different buyback models. An $800 million joint New South Wales and Federal government scheme will fund voluntary house purchases and repairs for up to 2000 homeowners affected by the 2022 Northern Rivers floods. This programme contributes towards the cost of home buybacks; resilient measures; relocation of homes; home raising, rebuilding and removal. By October 2024, the New South Wales government had made 825 buyback offers and contacted 352 householders about raising or retrofitting of homes to be more flood resilient (NSW Reconstruction Authority, 2024). Lismore's voluntary house purchase scheme is aimed at removing flood-prone structures inside the area prone to 1 in 20 year floods. A combination of insurance payouts for lost houses and a government and council-funded land swap was used to relocate 120 dwellings, or 85 per cent of the total, at Grantham after the 2011 flood destroyed the town. An estimated $30 million was saved in avoided costs in the 2013 floods, half the total costs of relocating the town. The Victorian government used a second buyback model after the 2010–2011 floods in the Lower Loddon river. Two options were provided: irrigated land in the identified flood plain was purchased and then resold as non-irrigated land at pre-flood prices to recoup costs; or farmers could remain, convert their land uses to flood-resistant farming and be compensated for the difference in value between high and lower land uses. Many houses, as a result, were moved from high-risk areas (Wenger, 2014).

2.13 The Problem of Insurance

The need to consider multiple interacting social and ecological factors in analysing risk is further illustrated by the likelihood of floods and their consequential impacts on insurance costs. Insurance costs are an accurate guide to the increasing severity and frequency of disastrous floods. The Insurance Council of Australia (ICA) has advocated a review of the adequacy of Australian land use planning regimes and building codes to prevent and respond to escalating climate catastrophes. New developments, it argues, must consider the consequence and likelihood of all possible severe weather events, including larger and more frequent floods, bushfires and cyclones, and consider future climate projections expected over the lifetime of the building. Only then will land use decisions play a critical role in reducing flood risk to homes, communities and businesses (Insurance Council of Australia, 2022b).

Since 1967, floods have cost insurers more than $23 billion, with more than $9 billion incurred in just the last 10 years. The February–March 2022 floods were the costliest Australian flood disaster, the second costliest natural disaster after the 1999 Sydney hailstorm and the world's fourth worst natural disaster in 2022. At $5.28 billion, the losses surpassed the $2.32 billion losses insurers from the 2019–2020 Black Summer bushfires, and were over double the $2.45 billion insurance loss incurred across all extreme weather events over the previous 12 months from July 2020 to June 2021 (Insurance Council of Australia, 2022a). The Insurance Council declared an Insurance Catastrophe for regions of Victoria, Tasmania and New South Wales affected by severe weather and flooding after 12 October 2022, the 11th such declaration since 2019 costing $13 billion in claims. It estimates that annual extreme weather will cost insurers $35.2 billion in 2050. Indirect costs were extensive, potentially affecting the broader Australian population through, for example, high food prices.

Insurance sources estimate that across all electorates in Australia, 3.6 per cent of properties (520,944) or one in every 25 properties will be uninsurable by 2030. In addition, one in 10 (9 per cent) of properties will reach the 'medium risk' classification by 2030. Of the properties classified as 'high risk' by 2030, the majority (80 per cent) of that risk is due to riverine flooding. The report *Uninsurable Nation* shows how vulnerability grows under higher-emission scenarios based on a 'climate risk map' developed by the Climate Council and data from Climate Valuation

(Climate Council, 2022). Other bodies are making similar estimates of risk. For example, Savvy has created a Maximum to Date Value at Risk (MVAR) of extreme weather and climate hazards using modelling from CSIRO, Universities of New South Wales and Queensland, the US National Oceanic and Atmospheric Administration and data from Climate Valuation to estimate the annual risk of damage to an asset. It proposes that high-risk properties will either be set a very high premium or refuse to insure a building.

2.14 Bushfire Planning—A Successful Model

A noticeable feature of Australian land use planning systems in recent decades is their decreased effectiveness in preventing harm from increasingly dangerous natural events. During the 1970s and 1980s, Victoria introduced world leading land use measures to anticipate future risk from bushfire hazard by introducing strong land use controls to prevent small lot subdivision and dwelling construction in the bushfire-prone Dandenong Ranges. Regulatory policies and statutory planning controls were accepted by both governments and citizens as an equitable and justified means of preventing harm. However, since the 1990s, neo-liberal governance models have been applied ever more rigorously to reduce controls over land use by deregulating planning systems. In Victoria, the potential for land use controls to reduce risk from bushfires has been all but forgotten leaving settlements in much of south-eastern Australia susceptible to increasing risk from bushfires.

The commitment by governments to neo-liberal planning practice is inconsistent with their stated concern for the increased risk to life and property from catastrophic natural events. Long ignored regulatory land use policies and statutory measures provide a model for future practice. A wide body of expert and community opinion has openly advocated for the need to return to regulatory controls to prevent future damage from floods, such as through prohibitions on building in flood plains, as shown above. However, governments stubbornly resist regulatory land use controls for bushfire planning.

The Dandenong Ranges, 35 km to the east of Melbourne, rise to 630 metres and are an iconic and much valued feature of the Melbourne landscape. As early as 1916, urban subdivision began to occur on a grand scale with the result that 72,000 people now live in settlements interspersed with a large national park, state parks and privately owned bushland. A

1974 Public Interest Research Group report commended that "the seeds for the urbanisation of Ranges … germinated in the early 1900s when much of this land was subdivided and sold in small bush blocks at auctions in the city (Goldin & Ripley, 1974, p. 31). The ranges are among the world's most bushfire prone, affected by 10 major bushfires and many smaller fires since 1900.

From the mid-1950s, successive Victorian governments began to buy back privately owned land and by the 1970s the government led by Sir Rupert Hamer began a systematic programme of purchasing tens of thousands of vacant urban lots. The government put in place an integrated policy, legislative, governance and land use structure, giving its intentions the force of legislation and quantified policy. Statement of Planning Policy (SPP) No 3, for example, stated that "there shall be no net increase in the total provision for residential development in the Dandenong Ranges". The Upper Yarra Valley and Dandenong Ranges Authority Act, 1976, required the regional authority to implement SPP3. The Act was a rare example of a regional authority empowered to bind the Crown (i.e., the State government).

The local council, the Shire of Sherbrooke, prepared even more restrictive planning controls, preventing further urban and rural subdivision, compulsorily restructuring thousands of existing small lots in 'old and inappropriate subdivisions', and applying tenement controls to prevent the construction of multiple lots held in the one ownership. The government through the 1980s continued a large-scale land purchase programme in the Dandenong Ranges and nearby foothills. This was a rare Australian example of State, regional and local government acting in harmony to achieve major environmental planning outcomes. Together, these actions prevented the construction of tens of thousands of additional dwellings in one of the world's most successful programmes to remedy historic errors of dangerous subdivision approvals.

The need to reduce risk from bushfire and protect a fragile environment formed compatible conservation and risk management objectives. The purchase of forested areas and regulatory controls over house construction on private land protected natural values and prevented the accumulation of risk to potential new residents. Hamer promised "a tight 'freeze' over potentially vulnerable or sensitive areas of particular significance which will prohibit all subdivision of land" (UYVDRA, 1980, p. ii). In 1979, 42 per cent of the 43,334 urban lots in the Upper Dandenong Ranges and Upper Yarra Valley region were vacant and the number of

vacant lots could potentially double through existing subdivision controls. The panel reviewing the regional strategy believed that the region's urban population of 71,198 could increase to 150,000 people in sensitive areas without further rezoning for residential use (UYVDRA, 1981). In addition, the potential for extensive rural dwelling construction on small lots existed, with 4727 of the total of 11,695 rural lots 0.4 ha or less, while 86 per cent of existing rural lots were below 10 ha, and over half were below 2 ha. About 62 per cent of non-urban lots did not contain dwellings (Norman, 1979). The Review Panel (1981) report estimated the number of rural lots at 17,273. The Investigations Report (UYVDRA, 1980, p. 4) concluded that "it is important to realize the possible impact on landscape and water quality … if all this potential for additional development is realized". The Review Panel emphasised:

> A hardline approach must be taken when applying planning controls in these areas. We believe that the incursion into rural land has been allowed to go too far and that if further penetration takes place the loss to the region will be irretrievable. (UYVDRA, 1981, p. 77)

This kind of thinking presumes the existence of an approach to governance which is foreign in Australia today.

2.15 Conclusion—Governance and Policy

Ultimately, preventive policy addressing risk from bushfires must be cross-sectoral. Norman and Sullivan (2011) highlight the need for integrated governance arrangements to address bushfire risk, arguing that integrated urban and regional planning offers a crucial cross-sectoral, multi-disciplinary, anticipatory and adaptive framework to address interrelated critical challenges. Spatial planning measures will need to address the increasing risk from climate change, the resulting social disruption and economic costs.

Successful long-term policy of the type which has prevented dwelling construction on flood plains and more recent risk analysis of coastal erosion will have to be applied to risk from bushfires. Most Australian governments have shown little interest in preventive measures such as regulatory prohibitions on dwelling construction in peri-urban areas to limit damage to life and property from bushfires. Ultimately, if the likely recent national

and international climate scenarios eventuate, this failure of anticipatory policy may lead to widespread abandonment of peri-urban rural-residential properties and a heightened risk to peri-urban townships and fringe urban suburbs.

References

ABC News. (2012, December 18). Victorian's pay dearly, but not a drop to drink.

Abram, N., et al. (2021). Connections of climate change and variability to large and extreme forest fires in Southeast Australia. *Communications Earth & Environment*. https://doi.org/10.1038/s43247-020-00065-8

Accounting for Nature. (2022). *The accounting for nature framework*. AfN Ltd.

Ademi, Z., et al. (2023). The hospitalizations for cardiovascular and respiratory conditions, emergency department presentations and economic burden of bushfires in Australia between 2021 and 2030: A modelling study. *Current Problems in Cardiology, 48*(1), 101416.

Alberti, M., & Marzluff, J. (2004). Ecological resilience in urban ecosystems: Linking urban patterns to human and ecological funding. *Urban Ecosystems, 7*, 241–265.

Alexandra, J. (2020). Burning bush and disaster justice in Victoria: Can regional planning prevent bushfires becoming disasters? In A. Lukasiewicz & C. Baldwin (Eds.), *Natural hazards and disaster justice* (pp. 73–92). Palgrave Macmillan.

Alexandra, J., & Finlayson, C. N. (2020). Floods after bushfires: Rapid responses for reducing impacts of sediment, ash and nutrient slugs. *Australian Journal of Water Resources, 24*(1), 9–11.

Argent, N., & Plummer, P. (2022). Counter-urbanisation in pre-pandemic times: Disentangling the influences of amenity and disamenity. *Australian Geographer, 53*(4), 379–403.

Argent, N., Tonts, M., Jones, R., & Holmes, J. (2010). Amenity-led migration in rural Australia: A new driver of local demographic and environmental change? In G. Luck, R. Black, & D. Race (Eds.), *Demographic change in Australia's rural landscapes* (pp. 23–44). Springer.

Arriagada, N. B., Bowman, M. J. S., Palmer, A. J., & Johnston, F. H. (2020). Climate change, wildfires, heatwaves and health impacts in Australia. In R. Akhtar (Ed.), *Extreme weather events and human health* (pp. 99–116). Springer Nature.

Attiwill, P., Ryan, M., Burrows, N., et al. (2014). Timber harvesting does not increase fire risk and severity in wet eucalypt forests of southern Australia. *Conservation Letters, 7*(4), 341–354.

Australian Government (2010) *Measures of Australia's Progress: Population*. Australian Bureau of Statistics, Canberra.

Australian Government. (2022). *Australia State of the Environment 2021.*

Bardsley, D., Prowse, T., & Siegfriedt, C. (2019). Seeking knowledge of traditional indigenous burning practices to inform regional bushfire management. *Local Environment, 24*(8), 727–745.

Bardsley, D., Weber, D., Robinson, G. M., & Moskwa, E. (2015). Wildfire risk, biodiversity and peri-urban planning in the Mt. Lofty ranges, South Australia. *Applied Geography, 63*, 155–165.

Bates, B., Kundzewicz, S., & Palutikov, W. (Eds.). (2008). *Climate and water. Technical paper of the intergovernmental panel on climate change*. IPCC Secretariat.

Beer, T., Gill, A., & Moore, P. (1988). Australian bushfire danger under changing climatic regimes. In G. Pearman (Ed.), *Greenhouse: Planning for climate change* (pp. 421–427). E.J. Brill.

Beer, T., & Ziolkowski, F. (1995). *Environmental risk assessment: An Australian perspective*. Supervising Scientist Report 102. Fenner Conference on the Environment. Australian Academy of Science.

Bekessey, S., Wintle, B., Pascoe, J., Fitzsimons, J., Morgain, R., & Spindler, R. (2022, December 20). The historic COP15 outcome is an imperfect game-changer for saving nature. Here's why Australia did us proud. *The Conversation*.

Bennett, G. (2019). *Dilemmas: Coping with environmental problems.* Routledge.

Bernard, A., Perales, F., & Charles-Edwards, E. (2024). *Climate migration in Australia: Level and socio-economic predictors*, *Working Paper No 2024/04*, University of Queensland: Queensland Centre of Population Research.

Biermann, F., Hickmann, T., Senit, C., Beisheim, M., Bernstein, S., et al. (2022). Scientific evidence on the political impact of the sustainable development goals. *Nature Sustainability, 5*, 795–800.

Blakeley, E., & Carbonell, A. (Eds.). (2012). *Resilient Coastal City regions: Planning for climate change in the United States and Australia*. Lincoln Institute of Land Policy.

Blakeley, E., & Fisher, P. (2017, February 7). We can learn a lot from disasters, and we now know some areas don't recover. *The Conversation*.

Block, K., Molyneaux, R., Gibbs, I., & Forbes, D. (2019). The role of the natural environment in disaster recovery: "We live here because we love the bush". *Health & Place, 57*, 61–69.

Boin, A., Ekengren, M., & Rhinard, M. (2020). Hiding in plain sight: Conceptualizing the creeping crisis. *Risk, Hazards & Crisis in Public Policy, 11*(2), 116–138.

Bond, T., & Mercer, D. (2013). Subdivision policy and planning for bushfire defence: A natural hazard mitigation strategy for residential peri-urban regions in Victoria. *Australia. Geographical Research, 52*(1), 6–22.

Boon, H., Millar, J., Lake, D., Cottrell, A., & King, D. (2012). *Recovery from disaster: Resilience, adaptability and perceptions of climate change*. Final Report, Gold Coast. National Climate Change Adaptation Research Facility (NCCARF).

Booth, K., & Tranter, B. (2018). When disaster strikes. Under-insurance in Australian households. *Urban Studies, 55*(14), 3135–3150.

Bourobe, E., Ramsay, I., & Ali, P. (2022). The arduous work of making claims in the wake of disaster: Perspectives from policyholders. *Geographical Research, 60*, 534–548.

Bradstock, R., & Gill, A. (2001). Living with fire and biodiversity at the urban edge: In search of a sustainable solution to the human protection problem in southern Australia. *Journal of Mediterranean Ecology, 2*, 179–195.

Bronnimann, S. (2018). Global warming (1970–present). In S. White, C. Pfister, & F. Mauelshagen (Eds.), *The Palgrave handbook of climate history* (pp. 321–353). Palgrave Macmillan.

Brouwer, F. (Ed.). (2022). *Handbook on the water-energy-food nexus*. Edward Elgar.

Bushfire Recovery Project. (2021). *Bushfire facts the science of forests, fires, climate and management*. Griffith University: Fenner School of Environment and Society.

Butt, A., & Fish, B. (2016). Amenity, landscape and forms of periurbanisation around Melbourne, Australia. In M. Kennedy, A. Butt, & M. Amati (Eds.), *Conflict and change in Australia's Peri-urban landscapes* (pp. 27–48). Taylor and Francis.

Buxton, M., Alvarez, A., Butt, A., & O'Neill, D. (2011a). *Scenario planning for Melbourne's Peri-urban region*. RMIT University.

Buxton, M., & Butt, A. (2020). *The future of the fringe, the crisis in Peri-urban planning*. CSIRO Press.

Buxton, M., Haynes, R., Mercer, D., & Butt, A. (2011b). Vulnerability to bushfire risk at Melbourne's urban fringe: The failure of regulatory land-use planning. *Geographical Research, 49*(1), 1–12.

Buxton, M., Phelan, K., Groenhart, L., & Butt, A. (2014). *Alternative futures for Melbourne's Peri-urban region*. RMIT University, Spatial Vision and La Trobe University.

Callaghan, J. (2021). Weather systems and extreme rainfall generation in the 2019 North Queensland floods compared with historical North Queensland record floods. *Journal of Southern Hemisphere Earth Systems Science, 71*, 123–146.

Callaghan, J. (2023). The eastern Australian floods of February 2022 and its relationship with climate change. *Journal of Energy and Power Technology, 5*(2), 014. https://doi.org/10.21926/jept.2302014

Canadell, J., Cook, G. A., Briggs, P., Knauer, J., Peple, A., & Haverd, V. (2021). Multi-decadal increase of forest burned area in Australia is linked to climate change. *Nature Communications, 12*, 6921. https://doi.org/10.1038/S41467-021-27225-4

Carpenter, S. (2002). Ecological futures: Building an ecology of the long now. *Ecology, 83*(8), 2069–2083.

Centre for Disaster Philanthropy (CDP). (2020). *Australian Bushfires*. https://disasterphilanthropy.org/disaster/2019-australian-wildfires/

Chambers, D., & Brettingham-Moore, C. (1967). *The bushfire disaster of 7th February, 1967*. Report and Summary of Evidence. Government of Tasmania.

Chang, S., Brown, J., Handmer, J., Helgeson, J., et al. (2022). Business recovery from disasters: Lessons from natural hazards and the COVID-19 pandemic. *International Journal of Disaster Risk Reduction, 80*, 103191.

Climate Council. (2022, May 3). Media release.

Climate Council of Australia. (2020). *Summer of crisis*. CCA.

Climate Council of Australia. (2022). *G'Day COP27: Australia's global climate reset*. CCA.

Climate Valuation (2022). *Visualising Climate Risk: An Interactive Map of Australia*. Melbourne.

Clun, R. (2023, January 13). Floods cost economy $5b as ill wind forecast to continue. *The Age*.

Colvin, R., Crimp, S., Lewis, S., & Howden, M. (2020). Implications of climate change for future disasters. In A. Lukasiewicz & C. Baldwin (Eds.), *Natural hazards and disaster justice* (pp. 25–48). Palgrave Macmillan.

Cook, M. (2019). *A river with a City problem: A history of Brisbane floods*. University of Queensland Press.

Cook, M., Frost, L., Gaynor, A., Gregory, J., Morgan, R., Shanahan, M., & Spearritt, P. (2022). *Cities in a sunburnt country: Water and the making of urban Australia*. Cambridge University Press.

Cook, T., & Werner, T. (2022, July 4). To stop risky developments in floodplains, we have to tackle the profit motive—and our false sense of security. *The Conversation*.

Cruz, M., Sullivan, A., Gould, J. S., Sims, N. C., Bannister, A. J., et al. (2012). Anatomy of a catastrophic wildfire: The Black Saturday Kilmore east fire in Victoria. *Australia, Forest Ecology and Management, 3*, 269–285. https://doi.org/10.1016/j.foreco.2012.02.035

CSIRO and Bureau of Meteorology. (2018). *State of climate report*. Australian Government.

CSIRO and Bureau of Meteorology. (2019). *Climate change information for Australia*. Australian Government.

CSIRO, BOM. (2022). *State of the climate 2022*. Commonwealth of Australia.

Cutter, S. (2016). The changing context of hazard extremes: Events, impacts, and consequences. *Journal of Extreme Events, 3*(2). https://doi.org/10.1142/S2345737616710056

Dadashpoor, H., & Ahani, S. (2019). Land tenure-related conflicts in peri-urban areas: A review. *Land Use Policy, 85*, 218–229.

Dawes, J. (2019). Are the sustainable development goals self-consistent and mutually achievable? *Sustainable Development, 28*(1), 101–117.

de Ruiter, M., Couasnon, A., van den Homberg, M., Daniell, J., Gill, J., & Ward, P. (2020). Why we can no longer ignore consecutive disasters. *Earth's Future, 8*(3). https://doi.org/10.1029/2019EF001425

de Vet, E., & Ericksen, C. (2020). When insurance and goodwill are not enough: Bushfire attack level (BAL) ratings, risk calculations and disaster resilience in Australia. *Australian Geographer, 51*(1), 35–51.

Deloitte Access Economics. (2016). *The economic cost of the social impact of natural disasters.* The Australian Business Roundtable for Disaster Resilience & Safer Communities. https://australianbusinessroundtable.com.au/our-research/social-costs-report

Duhr, S. (2023). Investigating the policy tools of spatial planning. *Policy Studies, 44*(2), 258–275.

Ebi, K., Vanos, J., Baldwin, J., Bell, J., Hondula, D., et al. (2021). Extreme weather and climate change: Population health and health system implications. *Annual Review of Public Health, 42*, 293–315.

Ellis, S., Kanowski, P., & Whelan, R. (2004). *National Inquiry on bushfire mitigation and management.* Commonwealth of Australia.

Feldmann-Jensen, S., Jensen, S., Smith, S., & Etkin, D. (2017). Towards a substantive dialogue: The case for an ethical framework in emergency management. *Australasian Journal of Disaster and Trauma Studies,* Palmerston North 20(1), 45–47.

Filkov, A., Ngo, T., Mathews, S., Telfer, S., & Penman, T. (2020). Impact of Australia's catastrophic 2019/20 bushfire season on communities and environment. Retrospective analysis and current trends. *Journal of Safety Science and Resilience, 1*, 44–56.

Fisher, P. (2012). Melbourne. In E. Blakeley & A. Carbonell (Eds.), *Resilient Coastal City regions. Planning for climate change in the United States and Australia* (pp. 145–180). Lincoln Institute of Land Policy.

Fletcher, M., Hall, T., & Alexandra, A. (2021). The loss of an indigenous constructed landscape following British invasion of Australia: An insight into the deep human imprint on the Australian landscape. *Ambio, 50*, 138–149.

Folke, C., Carpenter, S., Elmqvist, T., & Svedin, U. (2002). *Resilience and sustainable development: Building adaptive capacity in a world of transformations.* The Environmental Advisory Council to the Swedish Government.

Ford, A., Barr, S., Dawson, R., Virgo, J., Batty, M., & Hall, J. (2019). A multi-scale urban integrated assessment framework for climate change studies: A flooding application. *Computers, Environment and Urban Systems, 75*, 229–243.

Goldin, P., & Ripley, C. (1974). *The Dandenong ranges report.* Victorian Public Interest Research Group (PIRG).

Gonzalez-Mathieson, C., March, A., Leonard, J., Holland, M., & Blanchi, R. (2019). Urban planning: Historical changes integrating bushfire risk management in Victoria. *Australian Journal of Emergency Management, 34*(3), 60–66.

Gonzalez-Mathieson, C., Ruane, S., & March, A. (2021). Integrating wildfire risk management and spatial planning—A historical review of two Australian planning systems. *International Journal of Disaster Risk Reduction, 53*, 101984.

Goodspeed, R. (2020). *Scenario planning for cities and regions: Managing and envisioning uncertain futures.* Lincoln Institute of Land Policy.

Griffiths, T. (2001). *Forests of ash. An environmental history.* Cambridge University Press.

Gullett, W. (2000). The precautionary principle in Australia: Policy, law and potential precautionary EIAs. *Risk, Health, Safety and Environment, 11*(2), 93–123.

Handmer, J., Ladds, M., & Magee, L. (2018). Updating the costs of disasters in Australia. *Australian Journal of Emergency Management, 33*(2), 40–46.

Handmer, J., McLennon, B., Towers, B., Whittaker, J., & Yardle, F. (2013). *Emergency management and climate change: An updated review of the literature 2009–2012.* National Climate Change Adaptation Research Facility.

Hanna, C., Cretney, R., & White, I. (2022). Re-imagining relationships with space, place, and property: The story of mainstreaming managed retreats in Aotearoa-New Zealand. *Planning Theory & Practice, 23*(5), 681–702.

Hannam, P. (2022, October 16). CSIRO abruptly scraps globally recognised climate forecast program. *The Guardian*.

Hannam, P. (2023, January 9). 'Disasters like the Kimberley floods 'becoming less natural', Bowen says. *The Guardian*.

Hatch, P. (2022, November 7). The suburbs that will suffer most from Melbourne's planning failure. *The Age* (Melbourne).

House of Representatives. (2024). *Flood failure to future fairness. Report on the inquiry into insurers' responses to 2022 major floods claims.* Parliament of Australia.

Hugo, G. (2008). Immigrant settlement outside of Australia's capital cities. *Population, Space and Place, 14*(6), 553–571.

Ingles, O. (1991). A linguistic approach to hazard, risk and error. In J. Handmer, B. Jhtton, B. Guerin, & M. Smithson (Eds.), *New perspectives on uncertainty and risk* (pp. 66–79). Centre for Resource and Environmental Studies, Australian National University, and Mt Macedon, Australian Disaster College.

Insurance Council of Australia. (2022a). *Insurance catastrophe resilience report 2021–22.* NSW.

Insurance Council of Australia. (2022b). *Building a more resilient Australia: Policy proposals for the next Australian government.* NSW.

Insurance Council of Australia. (2022c, February 22). 'ICA ends support for Warragamba Dam wall plan'. Insurance News.com.au.

Intergovernmental Panel on Climate Change. (IPCC). (2018). *Summary for Policymakers of IPCC Special Report on Global Warming of 1.5 Degrees Approved by Governments.* IPCC.

Intergovernmental Panel on Climate Change. (IPCC). (2023). *Climate Change 2023, Synthesis Report of the Intergovernmental Panel on Climate Change (IPCC)*. 10.59327/IPCC/AR6-9789291691647.

Ishiwatari, M. (2022). Disaster risk reduction. In M. Lackner, B. Saijadi, & W. Y. Chen (Eds.), *Handbook of climate change mitigation and adaptation* (pp. 3019–3045). Springer International Publishing.

Ismail-Zadeh, A., Cutter, S., Takeuchi, K., & Paton, D. (2016). Forging a paradigm shift in disaster science. *Natural Hazards, 86*(2), 969–988.

Johnson, L., & Olshansky, R. (2017). *After Great Disasters*. Lincoln Institute of Land Policy.

Johnston, E., Cresswell, I., & Janke, T. (2022, July 19). *This is Australia's most important report on the environment's deteriorating health. We present its grim findings*. The Conversation.

Johnston, L., Blanchi, R., & Jappiot, M. (2020). Wildland-urban Interface. In S. Manzello (Ed.), *Encyclopedia of wildfires and wildland-urban Interface (WUI) fires*. Springer Nature.

Jones, M., Abalzoglou, J., Veraverbeke, S., Andela, N., Lasslop, G., et al. (2022). Global and regional trends and drivers of fire under climate change. *Reviews of Geophysics, 60*(3). https://doi.org/10.1029/2020RG000726

Keating, A., & Handmer, J. (2022). Wildfire risk management under climate change. In R. Shaw (Ed.), *Handbook on climate change and disasters* (pp. 99–113). Edward Elgar.

Keelty, M. (2011). *A shared responsibility. The report of the Perth Hills bushfire*. Government of Western Australia.

Koziol, M., O'Malley, N., Cormack, L., & Grieve, G. (2022, March 4). 'Face reality': Don't build in flood prone areas, resilience boss says. *Sydney Morning Herald*.

Kreibich, H., Van Loon, A., Schroter, K., Ward, P., Mazzoleni, M., et al. (2022). The challenge of unprecedented floods and droughts in risk management. *Nature, 608*, 80–86. https://doi.org/10.1038/s41586-022-04917-5

Kubiszewski, I., Jarvis, D., & Zakariyya, N. (2019). Spatial variations in contributors to life satisfaction: An Australian case study. *Ecological Economics, 164*, 106345.

Lagadec, P. (2009). A new cosmology of risks and crises: Time for a radical shift in paradigm and practice. *Review of Policy Research, 26*, 473–486.

Laming, A., Fletcher, M. S., Romano, A., Mullett, R., et al. (2022). The curse of conservation: Empirical evidence demonstrating that changes in land-use legislation drove catastrophic bushfires in Southeast Australia. *Fire*. https://doi.org/10.3390/fire5060175

Lange, J., & Gillespie, J. (2022). Bushfire, prescribed burning, and non-human protection. *Geographical Research*. https://doi.org/10.1111/1745-5871.12558

Lefebvre, M., & Reinhard, J. (2022). *The cost of extreme weather. Building resilience in the face of disaster*. McKell Institute.

Lindenmayer, D., Taylor, C., & Blanchard, W. (2021). Empirical analyses of the factors influencing fire severity. *Ecosphere, 12*(8), e03721. https://doi.org/10.1002/ecs2.3721

Llausàs, A., Buxton, M., & Beilin, R. (2016). Spatial planning and changing landscapes: A failure of policy in peri-urban Victoria, Australia. *Journal of Environmental Planning and Management, 59*(7), 1304–1322.

Lopez, A. (2023). Gaslighting: Fake climate news and big carbon's network of denial. In K. Fowler-Watt & J. McDougall (Eds.), *The Palgrave handbook of media misinformation* (pp. 159–177). Palgrave Macmillan.

Lukasiewicz, A. (2020). The emerging imperative of disaster justice. In A. Lukasiewicz & C. Baldwin (Eds.), *Natural hazards and disaster justice* (pp. 3–23). Palgrave Macmillan.

Macdonald, N., Chester, D., Sangster, H., & Hooke, J. (2012). The significance of Gilbert F. White's 1945 paper human adjustment to floods in the development of risk and Hazard management. *Progress in Physical Geography, 36*(1), 125–133. https://doi.org/10.1177/0309133311414607

Macintosh, A., Foerster, A., & McDonald, J. (2015). Policy design, spatial planning and climate change adaptation: A case study from Australia. *Journal of Environmental Planning and Management, 28*(8), 1432–1453.

Mackay, M., & Perkins, H. (2019). Making space for community in super-productivist rural settings. *Journal of Rural Studies, 68*, 1–12.

Mackey, B., Lindenmayer, P., Norman, C., Taylor, J., & Gould, S. (2021). Are fire Refugia less predictable due to climate change? *Environment Research Letters, 16*, 114028. https://doi.org/10.1088/1748-9326/ac2e88

Macquarie, L. (1817, March 5). Government and general orders government house. Civil Department.

March, A., de Moraes, N., & Stanley, J. (2020). Dimensions of risk, justice and resilience: Mapping urban planning's role between individual versus collective rights. In A. Lukasiewicz & C. Baldwin (Eds.), *Natural hazards and disaster justice* (pp. 73–92). Palgrave Macmillan.

Mariani, M., Connor, S., Theuerkauf, M., Herbert, A., Kunes, P., et al. (2022). Disruption of cultural burning promotes shrub encroachment and unprecedented wildfires. *Frontiers in Ecology and the Environment, 20*(5), 292–300.

McDermott, V., & Holdsworth, S. (2017). Fringe benefits? Planning, building and the development of community in a neo-liberal landscape. In P. Chan, & C. Neilson (Eds). *Proceedings of the 33rd annual ARCOM conference,* Cambridge, UK, pp. 662–671.

McDonald, J., & McCormack, P. (2022). Responsibility and risk-sharing in climate adaptation: A case study of bushfire risk in Australia. *Climate Law, 12*, 128–161.

McDougall, A., & Maharaj, V. (2011). Closing gaps on the urban fringe of Australian capital cities: An investment worth making. *Australian Planner, 48*(3), 131–140.

McGuirk, P., & Argent, N. (2011). Population growth and change: Implications for Australia's cities and regions. *Geographical Research, 49*(3), 317–335.

McKeown, R. (2022, January 12). Melbourne forecast to become Australia's biggest city. *The Urban Developer*.

McLeod, R. (2003). *Inquiry into the operational response to the January 2003 Canberra bushfires in the ACT*. Department of Urban Services.

McManus, P. (2021). A more-than-urban political ecology of bushfire smoke in eastern Australia, 2019–2020. *Australian Geographer, 52*(3), 243–256.

Miller, S., Carter, W., & Stephens, R. (1984). *Report of the bushfire review committee on bushfire disaster preparedness and response in Victoria, Australia, following the ash Wednesday fires of 16 February 1983*. Government Printer.

Milne, S., Hendriks, C., & Mahanty, S. (2020, April 9). From bushfires to coronavirus, our old 'normal' is gone forever. So what 's next?. *The Conversation*.

Morton, A. (2023, January 14). Three issues will decide if Labor's climate policy is a success—What the government does next is key. *Guardian Australia*.

New South Wales Joint Select Committee on Bushfires. (2002). *Report on inquiry into 2001/2002 bushfires*. NSW Parliament.

New South Wales Reconstruction Authority (2024) *Home raising, rebuild and relocation/resilient homes program*. New South Wales Government. https://www.nsw.gov.au/departments-and-agencies/new-reconstruction-authority/our-work/northern-rivers

Nohrstedt, D., Parker, C., Uexkell, N., Mard, J., Albrecht, F., et al. (2022). Disaster risk reduction and the limits of truisms: Improving the knowledge and practice interface. *International Journal of Disaster Risk Reduction, 67*, 102661. https://doi.org/10.1016/j.ijdrr.2021.102661

Nordenson, C. S., Nordenson, G., & Chapman, J. (2018). Reimagining the floodplain. In C. S. Nordenson, G. Nordenson, & J. Chapman (Eds.), *Structures of coastal resilience* (pp. 73–122). Island Press.

Norman, B. (1979). *Demand and supply of unimproved rural land in the upper Yarra Valley and Dandenong ranges region*. Report to Upper Yarra Valley and Dandenong Ranges Authority.

Norman, B. (2022). *Urban planning for climate change*. Routledge.

Norman, B., & Sullivan, K. (2011). Planning for risk and uncertainty. New approaches for managing urban growth. AFAC and Bushfire CRC conference, September, Sydney.

Norman, B., Weir, J., Sullivan, K., & Lavis, J. (2014). *Planning and bushfire risk in a changing climate*. Bushfire CRC.

NWF. (1998). *Higher ground. A report on voluntary property buyouts in the nation's floodplains: A common ground solution serving people at risk taxpayers and the environment*. National Wildlife Federation.

Nyberg, D., Wright, C., & Bowden, V. (2022). *Organising responses to climate change. The politics of mitigation, adaptation and suffering*. Cambridge University Press.

O'Neill, S., & Handmer, J. (2012). Responding to bushfire risk: The need for transformative adaptation. *Environmental Research Letters, 7*, 014018.

OECD. (2017). *The governance of land use in OECD countries: Policy analysis and recommendations*. OECD.

Oulahen, G., & Ventura, J. (2022). Planning use values or values-based planning? "Rolling with" neoliberal flood risk governance in Vancouver, Canada. *Environment & Planning E: Nature and Space, 6*(4), 2700–2720. https://doi.org/10.1177/25148486221140878

Owens, S. (2022). Foreword. In *Lessons from the history of UK environmental policy*. The British Academy.

Peterson, D. (2006). Precaution: Principles and practice in Australian environmental and natural resource management. In *50th Annual Agricultural and Resource Economics Society conference*. Manly, 8–10 February.

Power, J. (2022, March 22). NSW Planning Minister scraps order to consider flood, fire risks before building. *Sydney Morning Herald*.

Power, S., & Callaghan, J. (2016). The frequency of major flooding in coastal Southeast Australia has significantly increased since the late 19th century. *Journal of Southern Hemisphere Earth Systems Science, 66*, 2–11.

Price, O., & Bradstock, R. (2012). The efficacy of fuel treatment in mitigating property loss during wildfires: Insights from analysis of the severity of the catastrophic fires in 2009 in Victoria, Australia. *Journal of Environment Management, 113*, 146–157.

Rahman, R. (2023). Active inaction: Why the climate crisis is a moral crisis. *Local Environment, 28*(1). https://doi.org/10.1080/135449839.2022.2134323

Read, P., & Denniss, R. (2020, January 17). With costs approaching $100 billion, the fires are Australia's costliest natural disaster. *The Conversation*.

Redman, E. (2022, March 17). A million homes at risk of flooding by 2030, new modelling shows. *Sydney Morning Herald*.

Reid, K., Beilin, R., & McLennan, J. (2020). Communities and responsibility: Narratives of place-identity in Australian bushfire landscapes. *Geoforum, 109*, 35–43.

Reidmiller, D., Avery, C., Easterling, D., Kunkel, K., Lewis, M., Maycock, T., & Stewart, B. (Eds.). (2018). *Impacts, risks, and adaptation in the United States: Fourth National Climate Assessment, volume II*. U.S. Global Change Research Program. https://doi.org/10.7930/NCA4.2018

Renaud, F., & Perez, R. (2010). Climate change vulnerability and adaptation assessments. *Sustainability Science, 5*(2), 155–157.

Royal Commission into National Natural Disaster Arrangements. (2020). *Final Report*. Commonwealth of Australia.

Ruane, S., Babb, C., & Shahidul Hasan Swapan, M. (2022). Considering sustainability trade-offs in bushfire policy for the wildland-urban interface. *Environmental Hazards*. https://doi.org/10.1080/1747891.2022.2130860

Rugendyke, B., & Vanclay, J. (2022). Reimagining flood plain development with geography at heart. *Australian Geographer*. https://doi.org/10.1080/00049182.2022.2145414

Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., & Fuller, G. (2021). *Sustainable development report 2020*. Cambridge University Press.

Schreider, S., Smith, D., & Jakeman, A. (2000). Climate change impacts on urban flooding. *Climate Change, 47*, 91–115.

Senate Select Committee on Australia's Disaster Resilience. (2024). *Boots on the ground: Raising resilience*. Commonwealth of Australia.

Siembieda, W. (2020). Urban and land use planning. In S. Manzello (Ed.), *Encyclopedia of wildfires and wildland-urban Interface (WUI) fires*. Springer Nature.

Spataru, A., Faggian, R., & Docking, A. (2020). Principles of multifunctional agriculture for supporting agriculture in metropolitan peri-urban areas: The case of greater Melbourne, Australia. *Journal of Rural Studies, 74*, 34–44.

Speer, M. (2008). On the late twentieth century decrease in Australian east coast rainfall extremes. *Atmospheric Science Letters, 9*, 160–170.

Spratt, D., & Armistead, A. (2020). *Fatal calculations. How economics has underestimated climate damage and encouraged inaction*. Breakthrough-National Centre for Climate Restoration.

Stanley, J., Birrell, R., Brain, P., & Wright, W. (2013). *What would a climate-adapted settlement look like in 2030? A case study of Inverloch and Sandy point*. National Climate Change Adaptation Research Facility (NCCARF).

Steffen, W., Hughes, L., & Pearce, A. (2015). The heat is on: Climate change, extreme heat and bushfire in Western Australia. https://www.climatecouncil.org.au/uploads/7be174fe8c32ee1f3632d44e2cef501a.pdf

Steffen, W., Rockström, J., Richardson, K., Lenton, T. M., Folke, C., & Schnelinhuber, H. (2018). Trajectories of the earth system in the Anthropocene. *Proceedings of the National Academy of Sciences, 115*(33), 8252–8259. https://doi.org/10.1073/pnas.1810141115

Stephenson, C., Handmer, J., & Betts, R. (2013). Estimating the economic, social and environmental impacts of wildfires in Australia. *Environmental Hazards, 12*(2), 93–111.

Supran, G., & Oreskes, N. (2020). Addendum to 'assessing ExxonMobil's climate change communications (1977–2014)' Supran and Oreskes (2017 *environmental research letters*, 12, 084019). *Environmental Research Letters, 15*(4), 119401. https://doi.org/10.1088/1748-9326/ab89d5

Swiss Re Group. (2018, December 18). Media release: preliminary sigma estimates for 2018: Global insured losses of USD 79 billion are fourth highest on sigma records, Zurich.

Taylor, E. (2015). Urban growth boundaries and betterment: Rent-seeking by landowners on Melbourne's expanding urban fringe. *Growth and Change, 47*(2), 259–275.

Teague, B., McLeod, R., & Pascoe, S. (2010). *Final report: 2009 Victorian bushfires Royal Commission*. Government of Victoria.

The Lancet. (2022). The 2022 report of the *Lancet* Countdown on health and climate change: Health at the mercy of fossil fuels. *The Lancet*. https://doi.org/10.1016/S0140-6736(22)01540-9.

Tonts, M., & Horsley, J. (2019). The neoliberal countryside. In M. Scott, N. Gallent, & M. Gkartzios (Eds.), *The Routledge companion to rural planning* (pp. 114–124). Routledge.

Tract Consultants and Deloitte Access Economics. (2015). *Liveable Melbourne*.

Ulubasoglu, M. (2020, February 27). Natural disasters increase inequality. Recovery funding may make things worse. *The Conversation*.

United Nations. (2016). *Sendai framework for disaster risk reduction 2015–2030*. United Nations Office of Disaster Risk Reduction.

United Nations Environment Programme (UNEP). (2020). *Issue brief SDG 11*. UNEP.

UYVDRA (Upper Yarra Valley and Dandenong Ranges Authority). (1980). *Regional strategy plan. Investigations report*. Upper Yarra Valley and Dandenong Ranges Authority.

UYVDRA (Upper Yarra Valley and Dandenong Ranges Authority). (1981). *Report on the upper Yarra Valley and Dandenong ranges regional strategy plan*. Dandenong Ranges Authority; Regional Strategy Plan Review Panel.

Valcarcel-Aguiar, B., Murias, P., & Rodriguez-Gonzalez, D. (2019). Sustainable urban liveability: A practical proposal based on a composite indicator. *Sustainability, 11*(1), 86. https://doi.org/10.3390/su11010086

van Oldenbourgh, G., Krikken, F., Lewis, S., & Otto, F. (2021). Attribution of the Australian bushfire risk to anthropogenic climate change. *Natural Hazards and Earth System Sciences, 21*(3), 941–960.

Victorian Competition and Efficiency Commission (VCEC). (2008). *A state of liveability: An inquiry into enhancing Victoria's liveability*.

Vogel, E. (2022, October 19). Farm floods will hit food supplies and drive up prices. Farmers need help to adapt as weather extremes worsen. *The Conversation*.

Weichselgartner, J., & Pigeon, P. (2015). The role of knowledge in disaster risk reduction. *International Journal of Disaster Risk Science, 6*, 107–116.

Wenger, C. (2014). Sink or swim, alternative approaches to flood disaster reconstruction and mitigation. In V. Squire, H. Milner, & K. Daniell (Eds.), *River Basin Management in the Twenty-First century, understanding people and place* (pp. 418–445). CRC Press.

White, G. (1942). *Human adjustment to floods. A geographical approach to the flood problem in the United States*, Research Paper No 28. University of Chicago.

World Economic Forum. (2021). *The global risks report 2021*. WEF.

World Meteorological Organization. (2020). *Provisional statement on the state of the global climate in 2019*. WMO.

World Wildlife Fund (WWF). (2020). *Australia's 2019–2020 bushfires: The wildlife toll*. World Wildlife Fund for Nature Australia. https://files.worldwildlife.org/wwfcmsprod/files/Publication/file/s9a7ghpfl_WWF_AUS_Bushfire_Fund_Final_Report_FINAL.pdf?_ga=2.171511456.1881869942.1710078977-469059904.1710078977

Wright, S. (2023, January 1). Miscalculation on population boom. *The Age* (Melbourne).

Yeates, C. (2023, January 31). 'Someone has to pay': What to do about surging insurance costs?. SMH, p. 15.

Yebra, M., Barnes, N., Bryant, C., Cary, G., Durrani, S., et al. (2022). An integrated system to protect Australia from catastrophic bushfires. *Australian Journal of Emergency Management, 36*(4), 20–22.

Young, T., Lucas, C., & Booth, K. (2022). Insurance, fire and the Peri-urban: Perceptions of changing communities in Melbourne's rural-urban interface. *Australian Geographer, 53*(1), 41–60.

Zenkteler, M., Foth, M., & Hearn, G. (2022). Lifestyle cities, remote work and implications for urban planning. *Australian Planner*. https://doi.org/10.1080/07293682.2022.2096086

Zscheischler, J., Westra, S., van den Hurk, B. B. J. M., Seneviratne, S. I., Ward, P. J., et al. (2018). Future climate risk from compound events. *Nature Climate Change, 8*, 469–477. https://doi.org/10.1038/s41558-018-0156-3

CHAPTER 3

The 2018 East Attica Wildfire

Anna Apostolidou and Wolfgang Seibel

3.1 Introduction

On Monday, 23 July 2018, a wildfire broke out in Eastern Attica, Greece, that left more than 100 people dead, making it the deadliest fire in the country's modern history.[1] While initial governmental statements pointed to arson ("Toskas: Ypeballa paraitisi", 2018), it soon turned out that the fire started by accident in Penteli, a North Eastern suburb of Athens, when a 65-year-old male resident burned dry branches and trash and the fire got out of control (Souliotis, 2018b). Due to strong winds, the fire spread eastwards at extreme speed, completely overwhelming any form of

[1] Reportedly, the East Attica Wildfire of 2018 was the second deadliest one in the twenty-first-century worldwide, the first being the 2009 Australian wildfires described in Chap. 2; cf. "I deyteri pio foniki pyrkagia" (2018).

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firefighting or other assistance. At 16:49 local time on 23 July 2018, the fire department received an alarm concerning a fire that had broken out at the foot of Mount Pentelikon, approximately 20 kilometres north-east of Athens and 5 kilometres west of the Eastern Attica coast. It was the second wildfire to break out in the Attica region that day, the first having started earlier that afternoon near the town of Kineta, 45 kilometres west of Athens. The fire service responded to the Kineta fire with 47 water tenders, 110 firefighters, 3 Canadair and 2 Erickson helicopters. Three of the nearby settlements were evacuated (Gourmpatsis, 2018; Souliotis, 2018). That fire was still burning in Kineta when the fire brigade received the alarm of the new fire on Mount Pentelikon. Within 20 minutes, 22 water tenders and a helicopter were sent to the scene. Meanwhile, the Athens municipality ordered the evacuation of around 1400 children who were on holiday at summer camps in the affected region. Half an hour later, by 17:20, the fire had split into two fronts: one towards the beach on the east and the other towards the settlement of Kallitechnoupoli on the south-east. While the fire of the second front was successfully extinguished (Gourmpatsis, 2018), the first front of the wildfire approached the settlement of Neos Voutzas. Further air support arrived at 18:12, but by 18:13 the fire had reached Marathonos Avenue. The local commander of the traffic police received orders to stop traffic on Marathonos Avenue, but only for cars heading towards the fire front, not so for cars leaving the area (Souliotis, 2018). By 18:40, the fire had reached the seafront. At 20:00, the Coast Guard received orders to approach the burning coastline and rescue people who had gone into the sea to escape the fire. Due to its commitment to the Kineta fire, however, the Fire Brigade's available resources were severely limited. In total, the Fire Brigade deployed 60 firefighters in 24 vehicles, 15 vehicles owned by registered volunteers, 2 ground force teams, as well as 3 Canadair aircraft and 1 helicopter to the Mati wildfire (Lekkas et al., 2018; Souliotis, 2018).

The total number of confirmed casualties eventually reached 104; the last registered victim was a 70-year-old woman who passed away four years after the wildfire after multiple health problems from smoke inhalation ("Mati: Katelixe alli mia egkavmatias", 2022). In sum, 55 females and 49 males were confirmed dead, including 11 children ("Fotia sto Mati", 2018; "Mati: Ta onomata ton 102 nekron sti foniki pyrkagia", 2021). The oldest victim was 93 years old and the youngest only 6 months old ("Fotia sto Mati, 2018"). The fatalities were mostly Greek, but there were also 2 Polish, 1 Irish, 1 Belgian and 1 Georgian victims ("Fotia sto Mati, 2018").

This official list of the 104 wildfire victims includes the 13 people who escaped the fire but drowned in the sea while waiting for rescue ("Mati: 13 apo tous 99 nekrous", 2018). Twenty-seven people were found dead in a single plot near the coast. Presumably, they followed a narrow street leading to a cliff above the sea; a 13 year old attempted to jump and killed herself, while her father and brother followed other escapees to a nearby plot, where eventually the flames caught up with them. Many corpses were found embracing each other ("To oikopedo tis frikis", 2018; "Allos enas nekros", 2018).

A research team led by Professor Lekkas of the University of the Aegean, using satellite data from the COPERNICUS Emergency Management Service, estimated the fire-affected area to be approximately 12.8 km^2 (Lekkas et al., 2018). This area included 2488 completely destroyed buildings and 380 burned vehicles (Souliotis, 2018). In addition, the low and medium voltage electricity distribution networks, as well as the water supply networks, received extensive damages. By 1 August, 100% of the region's water supply and 90% of its electricity supply had been restored ("Restorations in Mati", 2018).

On the evening of 23 July, Greece requested the activation of the EU Civil Protection Mechanism. Cyprus, Spain, Bulgaria, Italy, Romania and Croatia sent aircrafts, firefighters, medics and vehicles (Sharman, 2018; "Kyma allileggyis", 2018). Christos Stylianidis, the Cypriot EU Commissioner for Humanitarian Aid and Crisis Management, travelled in Greece and coordinated the EU assistance. Other countries offered financial assistance and moral support ("Kyma allileggyis", 2018).

3.2 Background and Vulnerabilities: Wildfire Seasons, Socio-Economic Change

The overwhelming majority of fires in Greece originate from involuntary or voluntary human action, although the immediate cause of a large percentage of all forest fires cannot be defined. Yet, as with the other natural disasters presented and analysed in this volume, the shocking consequences of the East Attica wildfire resulted from various risk factors whose significance was, in principle, recognisable for the relevant policymakers even before climate change aggravated their potential impact.

Following the extremely devastating wildfires of July 2018, then Prime Minister Alexis Tsipras commissioned an expert committee ("Committee

for the Prospects of Managing Forest and Countryside Fires in Greece") to analyse the causes of wildfires and propose prevention strategies. The committee was chaired by Professor Johann Goldammer, Director of the Global Fire Monitoring Centre (GFMC) at the Max Planck Institute for Chemistry, University of Freiburg, Germany. It estimated that the proportion of fires of unknown origin during the period 1984–2009 was over 50%. During the same period, the committee found that arson accounted for 13% of the total number of fires and 12% of the area burned, while negligent arson accounted for 18% and 11%, respectively. Most forest fires occur in coastal, hilly and sub-mountainous areas at altitudes between 0 and 600 metres, where deciduous and pine forests tend to dominate. The fire season in Greece lasts from 1 May to 31 October (Mayraganis, 2016). August is considered the most dangerous month for wildfires, followed by July. Since 1973, both the number of fires and the area burned have increased (Goldammer et al., 2019) (Fig. 3.1). However, a journalist from the *Huffington Post* noted that the actual number of wildfires seems to have decreased during the first years of the financial crisis (since 2008) (Mayraganis, 2016).

Until the Mati wildfire of 2018, the most destructive wildfire season in Greece occurred in 2007 in the Peloponnese and Euboea. The region of Ilia in the Peloponnese suffered the greatest losses, both in terms of human lives and areas burned. An entire village, Artemida, was burnt down and 25 of its inhabitants died when surrounded by flames as they tried to escape. In total, 63 people died as a result of the 2007 wildfires. Fires tend to begin in areas with Mediterranean vegetation type, such as broadleaf bushes and coniferous species. It is also worth mentioning that pine forests are the dominant vegetation type that surrounds urban centres.

According to the so-called Goldammer report (Goldammer et al., 2019), during the period 1961–2000, Greece experienced major socio-economic changes, such as the migration of the rural population to the big cities and the expansion of urban centres, which led to conflicts over land use. In the absence of a legal framework and a national cadastre, public forest land was subject to arson and encroachment. The authors attribute the increase of wildfires number to the increase in economic activity, such as the boom in tourism on the islands (ibid., p. 5): Until the mid-1970s, most fires were caused by negligence, but in the late 1970s arson increased sharply. In the same decade, farmers began to burn forests more frequently in order to convert them into farmland. However, urbanisation in the 1980s, combined with the abandonment of low-productivity farmland,

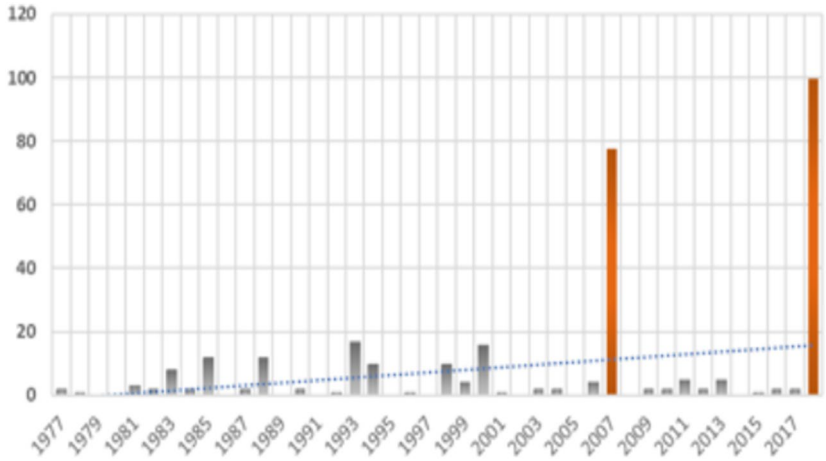

Fig. 3.1 Human losses from forest fires in Greece, 1977–2018. (Source: Goldammer et al. (2019))

led to the desertification of agricultural land. The number of farmers and livestock breeders has been steadily decreasing, while other service industries, especially tourism, have been expanding, leading to the degradation of natural resources in ecologically sensitive areas such as coastal forests. In addition, the economic exploitation of forest areas in those regions with high population density and land value (e.g., coastal forests and shingles in tourist areas) is also blamed for the highest percentage of forest fires caused by human activities.

3.3 Root Causes of the East Attica Wildfire

Due to its unprecedented scale and catastrophic impact on human lives and habitats, the 2018 Attica wildfire was subject to intensive analyses from both a scientific and a media perspective. Two scholarly studies standout in this respect. One is the already-mentioned report by Goldammer et al. (2019) commissioned by then Prime Minister Tsipras, the other one an independent analysis conducted by Professor Lekkas and his team at the University of the Aegean (Lekkas et al., 2018). While Goldammer et al. (2019) came up with an in-depth study of the long-term facilitators of wildfires threatening human lives and settlements, Lekkas

et al. included the short-term omissions and tactical errors of the Fire Brigade and other authorities in their analyses.

The questions of "what caused what" remained disputed, however, even among the experts. Wildfires occur frequently when the weather is characterised by drought and low humidity (Mast, 2018), which was the case in July 2018 in Attica. In addition, the velocity of the wind approximated 90 km/h (Lekkas et al., 2018) or even 120 km/h ("Greek wildfires", 2018). It is estimated that the wildfire crossed the main highway of the area within 30–40 minutes (Lekkas et al., 2018). Some researchers, including Lekkas et al. (2018) and Lindon Pronto (Mast, 2018), agree that the velocity of the fire allowed a minimal response time for the residents and the visitors in the affected areas. Lindon Pronto, in fact, claimed that the wind proved to be the deadliest factor of all (Mast, 2018). However, the prosecutors Ilias Zagoraios, Nikos Fystopoulos and Kostas Spyropoulos argued that the weather conditions were of minor importance: "The lack of organisation was of such gravity, that even if that particular fire with those particular characteristics had not taken place, it is certain that the same situation would prevail in even simpler events" ("Kolafos to porisma"). The debate on who is to blame and what could have been done to save the residents kept ongoing for quite a while (Georgiou, 2023).

Long-Term Facilitators

As several case studies in this volume illustrate, wildfires are linked to global climate change. The spread of the fire depends directly on the humidity of the combustible material, which in turn is determined by rainfall, relative humidity and the temperature and velocity of the wind. In Greece, the levels of rainfall have decreased if 1950 is taken as reference, increased with 1980 as the year of reference and tend to stabilise in the last 15 years. Fire risks have been strongly correlated with the level of humidity. More specifically, the influence of the yearly and summer drought is significant in the number of fires and burned area in Northern and Western Greece, while only summer drought is significant in Southern and Central Greece.

In accordance with this volume's general findings, Goldammer et al. (2019) stated that the fires occurring in the Wildland Urban Interface (WUI) are "perhaps the most serious threat to modern urban societies" (p. 47). In the region of Attica in particular, where the capital Athens and the now-notorious Mati settlement are located, settlements and individual

dwellings exist in the middle of woodland, forests and agricultural fields. The authors of the report attributed the Attica fires of 1981, 1992, 1998, 2001, 2005, 2009 and 2018, as well as the one of 1997 near Thessaloniki (Seih Sou) and the 1995 Kavala fires, to the WUI phenomenon. According to Goldammer et al. (2019), fire risk is increased in these areas due to

- the proximity of human activities to forest ecosystems (for recreation or business), in combination with
- insufficient infrastructure (e.g., road network, fire hydrants) and
- the urban population's lack of knowledge regarding fire hazards and ways to react in the event of one.

In their analyses, Goldammer et al. did not specifically address the phenomenon of illegal buildings as such. However, they explicitly pointed to the general problem of the arbitrary and inevitably random expansion of settlements and dwellings, whether illegal or legal, with no inspection by competent public authorities at all (Fig. 3.2):

> It is noteworthy that there is no credible mapping of the WUI areas at the national level. Recently attempts are being made through the forest maps, to delimit the areas of (arbitrary) residential densification, which constitute in particular high-risk zones of great vulnerability. Nevertheless, there are also many legitimate settlements (with approved plans) in forest areas which are equally exposed to wildfires. The problem of residential development within forests and forest areas, in an arbitrary and offensive manner, has not been systematically and conclusively dealt with, despite being on the political and social discourse of the country for many decades. Since the current situation has not been incorporated from the beginning into spatial and urban planning, the country planning is currently not meant to design but to provide solutions to the existing arbitrary situation. The major problem lies in arbitrary constructions (usually made with rough material and without permit), for which no recorded data exists. (p. 64)

Fire Management Deficiencies

In their report, Goldammer et al. (2019) underlined the absence of a national scientific coordinating agency in Greece, tasked with designing a strategy for fire protection linked to the operational capabilities. They also

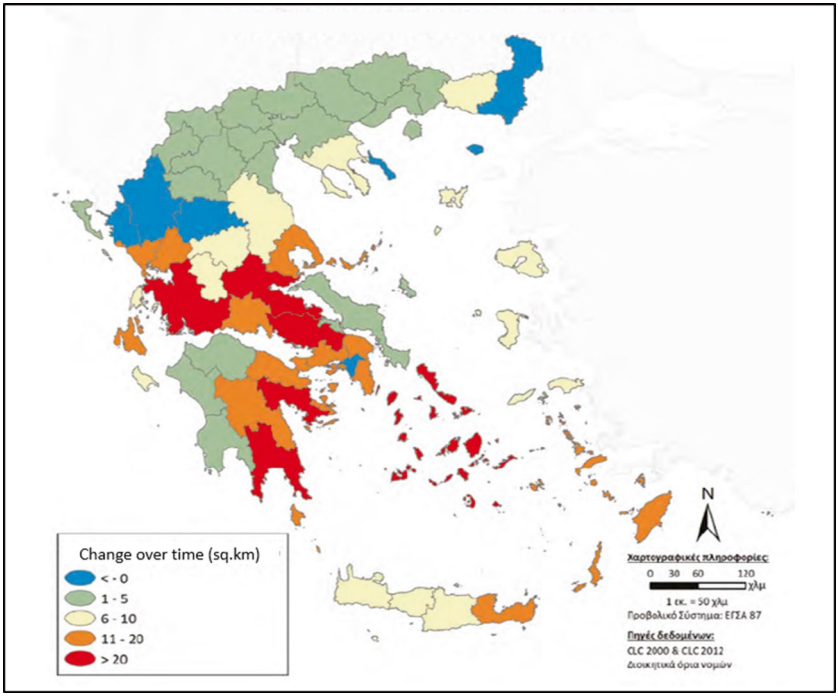

Fig. 3.2 Longitudinal change of the areas of Wildland Urban Interface (WUI) in Greece, 2000–2012. (Source: Goldammer et al. (2019))

highlighted the absence of a national fire protection plan[2] and criticised the Greek approach to fire management as fragmented, isolated and poorly coordinated, thus creating "corporate and departmental silos" (p. 82). This, according to the authors, also applied to the relationship between Fire Brigade and Forest Service which they characterised as non-cooperative in nature while jurisdictional issues were politicised regardless of technical criteria and effectiveness. In addition, firefighting personnel were considered to be insufficiently trained, resulting in the underuse of expertise, innovation and technology in firefighting. Another identified issue was that Greece put more emphasis on fire suppression rather than

[2] There is a national plan under the name "Xenokrates", which addresses all kinds of emergencies and disasters. There is no separate plan especially for wildfires though.

fire prevention, both in terms of budget and strategy. Combined with the adoption of the French model of firefighting, this has led to an excessive reliance on aerial firefighting and a downgrading of the role of ground forces and the potential contribution of volunteers.

Lekkas et al. (2018) noted that vegetation might have played a role in the spreading of the wildfire in East Attica. The region has dense vegetation areas. Forest zones from the mountains reach the coastline and are only interrupted by the main highway, Marathonos Avenue, which, however, failed to obstruct the fire in July 2018. Previous wildfires have repeatedly burned the west and southwest of the afflicted region, while the forest north of Neos Voutzas had remained unburned. The wildfire started in a previously burned area of low-lying vegetation but spread to an unafflicted area which fuelled the fire further. According to Lekkas et al. (2018), the change in fire behaviour might be due to the change in vegetation type.

When it comes to the many human lives claimed by the 2018 wildfire, the topography of the region played a decisive role since it not only strengthened the wind along the coastal front from Rafina to Nea Makri but also hindered access to the sea. Access to the beach was particularly difficult due to the steep slopes of the coast in the eastern part of the area. Moreover, dense smoke limited visibility and contributed to the entrapment of people (Lekkas et al., 2018).

Local Socio-economic Factors and Illegal Construction

Mati has long been a vacation resort with luxury villas and tourist infrastructure. The settlement belongs to the municipality of Marathon, where the overwhelming majority works in the tertiary economic sector (Elliniki Statistiki Archi, 2021). It was not possible to retrieve separate statistical data for the unfortunate settlement, with the exception of the data released by the Technical Chamber of Greece about illegal buildings. Though the phenomenon of illegal buildings will be examined further below in this chapter, the statistics on illegal buildings are indicative of the socio-economic status of the residents: 86% of the registered illegal buildings were vacation homes, while only 10% constituted first residence homes ("The Technical Chamber of Greece", 2018).

Given that some residents survived the fire by staying within their homes (Papazoglou, 2018), the quality of the constructions contributed to the death toll. Lekkas et al. (2018) reported that the fire did not spread to the interior of buildings with reinforced frame, brick infill-partition

walls and closed windows. On the contrary buildings with light timber framing system and plasterboards, materials characterised as "extremely cheap and inadequate" (Lekkas et al., 2018), were completely or partially destroyed. This calls into question whether it was the poorer residents who were affected the most by the wildfire and it also sheds light on the terrible consequences of tolerated illegal construction.

Another question that seems to have troubled the media, international media in particular, was whether the austerity that was imposed in Greece played a role in the high number of casualties (Piller, 2018; "Xena MME", 2018). The Italian newspaper *Corriere della Sera* maintained that the Greek response to the wildfire was weak because Athens was forced to cut expenses in its Civil Protection mechanism ("Xena MME", 2018), while the German *Frankfurter Allgemeine Zeitung* referred to critics who argued that Greece's creditors within the European Union were to blame since pressure on Greece to pay its debts on time had allegedly led to budget cuts at the expense of the Fire Brigade (Piller, 2018; "Xena MME", 2018). Interestingly enough, the Greek media have ignored or dismissed this issue. Professor George Bitros of Athens University of Economics and Business argued that the financial crisis had not yet taken place when the deadly 2007 Ilia wildfire occurred, and therefore austerity was not to blame (Piller, 2018). On the contrary, Infrastructure Minister Christos Spirtzis declared that additional 2500 people had been hired in the Fire Brigade during his tenure (he assumed office on 5 November 2016) ("Spirtzis: Gia tin pyrkagia", 2018).

Finally, when it comes to urban planning, illegal construction and insufficient fire protection, it mattered that the region of Mati is one of the very Wildland Urban Interface (WUI) zones that exist throughout Greece which, almost by definition, are exemplarily prone to wildfires with severe consequences (Lekkas et al., 2018; Skrepetos, 2018). The presence of numerous illegal buildings inevitably increases the risk to life and limb. According to the Technical Chamber of Greece, 971,000 houses in Greece had been registered in 2018 as partially or completely illegally built; the region of East Attica, which was affected by the wildfire, ranks 1st as it accounts for the 9.8% of illegal buildings in the country. In Mati, 327 buildings had been registered as "arbitrarily constructed", with almost half of it (156) being completely illegal. Fifty-two per cent of those 327 buildings had no construction permit at all. Ninety-three per cent of the registered illegal buildings were constructed outside the city plan. Seventeen per cent of the buildings were built before 1975, 32% in the period 1976–1982, 28% in the period 1983–2003 and 23% in the period

2004–2011: the current law on the legalisation of unauthorised real estate (N4495/2017) only allows legalisation for buildings constructed until 2011. In total, 24,455 sq.m. of illegal construction had been legalised in East Attica area ("The Technical Chamber of Greece", p. 18). Typically, though, the legalisation of unauthorised buildings prerequisites certification of active and passive fire safety (N44495/2017) but the standards differ for buildings built before and after 1989 (Π.Δ. 71/88 and ΠΔ 41/2018).

The widespread phenomenon of illegal construction and violations of the urban planning code were considered, especially by the government, to be important factors leading to the high number of casualties ("Greek wildfires", 2018; "Spirtzis: Gia tin pyrkagia", 2018). The illegal buildings not only raised pressing questions about the lack of law enforcement but also proved to be extremely detrimental to fire safety. Due to its arbitrary urban development, the Mati settlement was characterised by narrow streets (2.7 m at some locations), numerous dead ends, long road blocks, lack of places to gather (e.g., squares, playing fields) (Lekkas et al., 2018) and private fences that obstructed access to the sea ("Spirtzis: Gia tin pyrkagia", 2018). All of these factors played an important role in the trapping of residents and tourists on 23 July 2018. The narrow streets caused vehicle congestion (Lekkas et al., 2018), while the dense smoke from the fire impaired visibility (Mast, 2018). It is also noteworthy that a great number of tourists and visitors had no knowledge of the topography and geographical particularities of Mati and therefore could not find a way to escape (Lekkas et al., 2018) (Illustration 3.1).

Omissions and Tactical Errors

Soon after news of fatalities broke out, criticism about poor fire management and insufficient rescue began. The opposition, the majority of the media and independent investigators blamed almost all parties involved with the wildfire and the rescue of the population: the government in general, the General Secretariat of Civil Protection, the regional governor of Attica, the mayor of Marathon, the Fire Brigade, the Police and the Coast Guard.

According to all likelihood, serious mistakes were made already at an early stage. Andrianos Gourmpatsis, former Deputy Commander of the Fire Brigade, mentions in his report[3] that on 23 July no aerial monitoring

[3] Gourmpatsis' report was commissioned by two families who lost their relatives in the Mati wildfire. The families hired Mr. Gourmpatsis as their technical consultant.

Illustration 3.1 Mati topography and escape routes. (Source: Lekkas et al. (2018))

in Attica was active, neither in Kineta nor in Mati, although the Operational Plan of the Fire Brigade dictates one when the Fire Risk Category is at level 4, as was the case on that particular day (Gourmpatsis, 2018). If there would have been aircraft monitoring from afar, the fire probably would have been detected earlier. Gourmpatsis (2018) estimated that 30 minutes passed from the time the fire started until the Fire Brigade responded. Even then, the fire brigade's response was considered indecisive, as it only dispatched one aircraft (Gourmpatsis, 2018; Synolakis, 2018). A second aircraft arrived much later, when the fire had already passed the main highway, Marathonos Avenue ("Kolafos to porisma", 2019). Amid the first seven Fire Brigade vehicles that arrived at the ignition point, only three had firefighting capabilities ("Kolafos to porisma", 2019). Moreover, it is worth mentioning that the prosecutors Zagoraios, Fystopoulos and Spyropoulos revealed that the time stamps of the vehicle mobilisation as recorded by the Unified Coordination Operational Centre of the Fire Brigade were in fact inaccurate ("Kolafos to porisma", 2019).

Moreover, the simultaneous existence of another wildfire front in Attica caused the fragmentation of resources. While the government initially denied any mistakes in managing the fire, officials did acknowledge that

the primary focus was the concurrent Kineta wildfire ("Spirtzis: Gia tin pyrkagia", 2018). The media have uncovered documented talks between the various branches of the civil protection services that demonstrate the confusion that dominated when the second fire broke out ("Fotia Attiki", 2018). Such was the magnitude of miscommunication that the Coordination Centre did not even know who was in charge of the ground firefighting forces, who managed aerial firefighting, and where and how the East Attica Fire Brigade Commander Charalampos Chionis could be reached (Moustaka, 2019). No special experts panel was sent to coordinate the firefighting effort (Gourmpatsis, 2018); the Fire Brigade had no real overview of the situation, that is, the exact origin of the fire, the sources of the fire, the spread and/or which other agencies were on the scene and how they were cooperating with others ("Kolafos to porisma", 2019), and finally they could not predict that the new fire that had broken out on Pentelikon Mountain would reach the settlements of Neos Voutzas and Mati settlements (Gourmpatsis, 2018). Indicative of the confusion and the lack of preparedness is also the fact that communications between the Fire Brigade officers, as well as with other officials, were conducted through a variety of communication systems: landlines, radio, work mobile phones and personal mobile phones ("Kolafos to porisma", 2019). One example:

> At 18.14 the Deputy Commander of the Athens Fire Department contacts the fire emergency hotline "199".
>
> Deputy: "Do you understand what we are talking about? I am trying to call all this time to move the aircrafts because we cannot go north-northwest, it has reached the ridge and no-one responds. I turn to you and you don't answer either."
>
> 199: "Don't you have radio to talk directly with the aircrafts?"
>
> Deputy: "No, and I don't manage the aircrafts."
>
> 199: "Who does?"
>
> Deputy: "I don't know who manages them, they were calling whomever does, I am talking with the Centre and you are not responding." (Mandrou, 2019)

While a meeting of the Coordination Centre of the Fire Brigade was convened with all agencies involved as required by the Civil Protection mechanism rules, it turned out that its contribution was insignificant. In their report, the prosecutors describe the meeting as "just a bureaucratic necessity", where the participants only expressed their opinions without

defining specific actions ("Kolafos to porisma", 2019). Not even the Special Disaster Response Unit was mobilised ("Kolafos to porisma", 2019).

As the fire approached the settlements of Kallitechnoupoli, Neos Voutzas and Mati, there was no organised evacuation order, for which the fire brigade, the governor of Attica and the General Secretariat for Civil Protection are all being blamed (e.g., "Greek wildfires", 2018; Gourmpatsis, 2018). It is common knowledge that authorities must have evacuation plans and deploy resources to organise traffic flow (Synolakis, 2018). The nearby children summer camps and an orphanage were indeed evacuated according to plan, but the local population was not even alerted. Gourmpatsis (2018) states that the National Early Warning System, designed by the General Secretariat of Civil Protection, did not work at all for unknown reasons. When Greece adopted the European Emergency Number "112", it signed a contract that established a mass alert system according to which all mobile providers would send SMS alerts in bulk to local populations in case of a wildfire and at the request of the Operational Centre of Civil Protection. In fact, those who happened to be near the coast at the time were informed by those who had evacuated the uphill part of the Mati settlement (Lekkas et al., 2018). In their case file, the prosecutors argued that even without an official evacuation order, the local population would have had time to leave if only they had been warned (Mandrou, 2019). Moreover, a study commissioned by the parliamentary opposition and conducted by Professor Costas Synolakis showed that if there had been an official evacuation order, the affected region could have been evacuated in 57–83 minutes, in which case there would have been no casualties from the Mati wildfire (Synolakis et al., 2018).

Not only was there no organised evacuation order, but the centre of the fire department's emergency hotline "199" where trapped people called for help, was severely understaffed. There were only three operators on duty, and after some time the service was shut down because it could not handle all the incoming calls ("Porisma gia Mati: oi tilefonikes epikoinonies", 2019). Desperate operators often responded to callers in an irritated and rude manner, while attempting to direct them to other emergency services ("Porisma gia Mati: oi tilefonikes epikoinonies", 2019) that had neither the jurisdiction nor the capability to rescue people from the wildfire ("Kolafos to porisma", 2019). Example:

> Trapped caller: "Everything is burning around us, everything has burned, we are inside the house, there is a lot of smoke … our car has been destroyed, it's burned […]"
>
> Hotline operator: "Can't you just go slowly towards the beach? Do you have a car?"
>
> Trapped caller: "No, you guys, I have a 13-month-old baby, how long can it breathe, I don't know, do something!"
>
> Hotline operator diverts incident to the Operational Centre of Civil Protection (OCCP): "Can't the municipality put a vehicle to help? Ours are burning out."
>
> OCCP: "Yeah guys, you cannot call only my number, there are 3–4 more [phone lines] here. Can't this lady call 100 [the police emergency hotline number] to ask for a patrol car? Can't she say the same things to 100?" (Mandrou, 2019; "Porisma gia Mati: oi tilefonikes epikoinonies", 2019)

The fact that the evacuation process was unorganised and chaotic contributed to the congestion of people and vehicles in the narrow streets and their subsequent entrapment (Lekkas et al., 2018). In addition, the Greek traffic police made the mistake of sending drivers into the path of the fire. As the fire approached Marathonos Ave., the police diverted cars to alternative routes, one of which was through the Mati region, whereas they should have ordered drivers to make a U-turn ("Greek wildfires", 2018; Gourmpatsis, 2018; "Kolafos to porisma", 2019). In addition, the findings of the prosecutors' report revealed that the number of the police officers was insufficient and concluded that the Greek police was essentially completely unprepared for such an incident ("Kolafos to porisma", 2019). Traffic was further exacerbated by the decision of the Port Authority of the nearby port of Rafina to allow two ferry boats to dock and their vehicles and passengers to disembark, despite the wildfire situation being apparent by that time due to the dense smoke. The majority of the vehicles and passengers who disembarked from the ferries headed towards Athens through Marathonos Ave. and/or Mati ("Kolafos to porisma", 2019).

Finally, the Coast Guard has also been accused of delay in collecting the evacuees from the sea and the beaches, as 13 people who managed to reach the beach eventually drowned ("Mati: 13 apo tous 99 nekrous", 2018). Though the prosecutors' report did not put any blame on the Coast Guard, they did acknowledge that a number of people who survived the fire lost their lives in the sea. The leadership of the Fire Brigade was charged as well since they did not employ the two (out of three) firefighting ships anchored at the Piraeus port to assist the Port Authority/Coast

Guard of the smaller Rafina port in saving the fire survivors from the sea ("Kolafos to porisma", 2019).

In addition to human error in the immediate crisis management of the crisis, the existence of deep bureaucracy in relation to civil protection apparently played a role in the poor response and rescue management. Gourmpatsis (2018) points to the existence of various agencies with overlapping jurisdictions. Details are being presented and discussed in the subsequent section.

3.4 Response of the Government

After the national tragedy that occurred in Mati, the political debate centred on issues of accountability and responsibility, with the opposition and the media blaming the government at central and regional level, and the government itself denying that it had made mistakes. Government representatives focused on illegal buildings and seemed to commit into correcting the building distortions of the past. Amidst this debate, the residents of Mati started rebuilding their homes, which sparked new controversies with the government.

The denial of responsibility initially followed the familiar pattern of a blame game (Hood, 2001). Infrastructure Minister Christos Spirtzis of the governing Syriza party argued that the Region of Attica local government bore no responsibility since the governor of the Attica Region, Rena Dourou, a Syriza member, had immediately travelled to the Coordinating Centre of the Fire Brigade ("Spirtzis: Gia tin pyrkagia", 2018). Instead, he implied that the criticism which came from the media was due to synergy between the media and the opposition party, Nea Dimokratia ("Spirtzis: Gia tin pyrkagia", 2018). The government also tried to put the previous governments in the spotlight, arguing that the main factor for the tragedy were the partially or wholly illegal buildings in the region that were built before the Syriza party came to power, and which obstructed access to the beach. Spirtzis was quoted as saying, "[I]t should be investigated who gave permissions to these buildings" ("Spirtzis: Gia tin pyrkagia", 2018).

On the day after the wildfire, the Minister of Civil Protection, Nikos Toskas, submitted his resignation to the prime minister without, however, admitting any mistakes in the management of the crisis. The prime minister did not accept the resignation, claiming that "now is the time to battle" ("Toskas: Ypeballa paraitisi", 2018). The opposition, led by

conservative Kyriakos Mitsotakis, prompted for the resignations of those who had political responsibility, as well as those who handled the response to the fire.

It wasn't until three days after the wildfire broke out, and under the pressure and harsh criticism from the majority of the Greek media, that Prime Minister Alexis Tsipras eventually assumed political responsibility in a public televised statement ("A. Tsipras: Analambano", 2018). Despite rhetorically assuming responsibility, though, he ruled out the possibility of "decapitating" the leadership of the agencies which were involved in the fire management. In addition, Tsipras too blamed previous governments for tolerating illegal building practices, admitting that his administration had not achieved to correct the wrongdoings of the previous ones. It is also noteworthy that Tsipras did not mention at all the possibility of human error in handling the fire. Altogether, despite initial impressions, his statement of political responsibility was rather questionable ("Tsipras: Anelabe tin politiki eythyni", 2018). Triantafillidou and Yannas (2022) summarise his framing of the disaster as strategic ambiguity, with initially low levels of caring, shifting the blame to previous governments and presenting the catastrophe as a "critical opportunity" for correcting chronic problems of Greek infrastructure.

At the regional level, two Deputy Mayors of the Municipality of Marathon resigned, while a third municipal councillor distanced herself politically [4] from the Mayor Ilias Psinakis who was accused of being absent and indifferent to the plight of the local population ("Paraitithike kai dimotiki symboulos", 2018). The following days, 23 out of 30 municipal councillors officially requested the resignation of the mayor, characterising him as "dangerous for the region" ("Paraitisi Psinaki", 2018). Ilias Psinakis, in turn, claimed that the municipality was fully prepared to face the fire and that the municipal services assisted in every way the victims. He defended the municipal road-cleaning service that they preventively cleaned the streets from fire hazards and pointed to the Fire Brigade for the non-organised evacuation ("Psinakis gia Mati", 2018).

The governor of Attica, Rena Dourou, was blamed the most for the tragedy, not only from the media but also by victims' families ("Egklisi", 2018), especially for not ordering the evacuation of the citizens. Dourou claimed that the "regional government does not extinguish fires or

[4] The Deputy Mayors were Dimitra Lambarou and Vassilis Tsoupras; the municipal councillor mentioned was Anastasia Pappa.

evacuates preactively without the suggestion of the Fire Brigade" (Mandrou, 2018). At the subsequent criminal trial, all the political figures, including the regional governor, the mayors and deputy mayors, were acquitted, as well as some members of the fire brigade. As of June 2025, ten persons, including the arsonist and senior fire department officials,[5] were found guilty of manslaughter and bodily harm by negligence and were sentenced from 3 to 340 years in prison ("Oi poines gia tin pyrkagia sto Mati", 2025). Nonetheless, as most sentences were redeemable with only a five-year imprisonment, the court decision was considered quite lenient by the Greek society ("Diki Mati", 2024).

3.5 Lessons Learned?

While summer wildfires have become commonplace in Greece, the fires after the 2018 East Attica tragedy did not claim as many human lives. The year 2019 was characterised as "the best year in a decade for wildfires in Greece" (Lialios, 2019), as only ca. 162,000 hectares of forests and woodlands were burned (Gourmpatsis, 2020) vis-à-vis the 2009–2019 average of 259,500 hectares (Lialios, 2019). The number of wildfires and burnt area increased the years afterwards, with a record of 1,300,000 hectares of burnt area recorded in 2021 ("Dasikes pyrkagies", 2022) and more the years thereafter. Human casualties remained low until 2023, when 28 people died and 75 got injured in different locations (Gourmpatsis, 2023). The reason for the lower number of casualties is the implementation and extensive use of the Cell Broadcast Service from 2019 onwards under the new government of Nea Dimokratia, which sends evacuation alerts to the mobile phones in areas threatened by wildfires.

While the lesson of timely evacuations has been learned, few other systemic adjustments have been made. Greece still puts emphasis on the suppression of forest fires instead of prevention, having dedicated 84% of the

[5] The following were sentenced to 340 years in prison, with 5 years to be served: S. Terzoudis(Chief of Operations of the Fire Department), V. Mattheopoulos (Deputy Chief of Operations of the Fire Department), I. Fostieris (Commander of the Coordination Centre for Operations), I. Kapakis (Secretary General of Civil Protection). A total sentence of 238 years imprisonment, redeemable, was imposed on the following: Ch. Golfinos (Fire Department Executive) F. Panteleakos (Fire Department Executive), D. Papadopoulos (Fire Department Executive), N. Panagiotopoulos (Commander of the Athens Fire Service),Ch. Chionis (Commander of the Eastern Attica Fire Services). A sentence of 3 years imprisonment was imposed on the arsonist, K. Aggelopoulos.

total national funding for suppression and only 16% for prevention ("WWF Ellas, 2022"). The Nea Dimokratia government attempts to reform forest management, founding a new agency to monitor forests and implementing the fire protection project "Antinero" with the help of European Recovery Fund has been criticised as fragmented and inadequate (Karatziou, 2023). A major point of criticism is that the forestry services are excluded from the operational planning for wildfire extinguishing (Karatziou, 2023).

Lastly, during the 2018 Mati wildfire, the government put emphasis on illegal buildings and opened a public dialogue on the scourge of arbitrary constructions in Greece. Indeed, in his public statement, then Prime Minister Alexis Tsipras pledged that his administration would proceed swiftly with a national plan that would address decades of building arbitrations. He called for the participation of scientists, university, specialists and the opposition parties, saying that it will be a "national attempt" and everyone's "duty" to guarantee that no such tragedy occurs again ("A. Tsipras: Analambano", 2018). The first weeks after the Mati wildfire, the government compiled a list of 3200 illegal buildings in Attica that would be demolished (Xypnitou, 2018). While the Greek media documented the first dozen demolitions ("Authaireta: Xekinise i katedafisi", 2018), the fate of the rest illegal buildings has not been reported. It is worth noting that almost every year the Greek government announces programmes for the demolition of illegal buildings, mainly on beaches and forest areas (indicatively: Press Office, 2024; "YPEN", 2023; "Hatzidakis: De tha symbibastoume me tin authairesia", 2020). Nonetheless, former Inspector of Public Administration and retired Supreme Court Justice Leandros T. Rakintzis notes that the demolitions programmes often are not implemented due to bureaucratic hurdles, such as appeals in administrative courts, and underfunding of the national Special Service for Inspection and Demolition of Unauthorised Structures (Rakintzis, 2020). The arbitrary building situation has been characterised a "surrealistic reality" (Karatziou, 2024), as it is still flourishing and expanding via the many laws which have passed to actually restrict it.

Another logical assumption would be that the issue of the illegal buildings would be addressed through the private sector, in particular insurance companies. According to the Hellenic Insurance Companies Association, the sum of compensations for damaged properties in the fire-affected area has exceeded € 36 million. The owners of 835 buildings, either private or professional, claimed damages of a total € 34.5 million, while the

respective compensations for the declared 248 car damages approximate € 1.53 million ("Fotia Mati", 2018). Nevertheless, only 20% of the damaged houses in Mati were insured (Markopoulos, 2018); this percentage actually exceeds the national average of houses that have insurance against fire, which is only 15% (Koukakis, 2018). This discrepancy can be attributed that house loans are nowadays linked to insurance against a variety of damages (Markopoulos, 2018). The actual sum of the compensations is turned out to be way below the € 500 million that independent media originally assumed it would be (Markopoulos, 2018).

While it remains questionable whether the wildfire in East Attica in 2018 could have been contained given the topography, weather conditions and the irregular state of the settlements and roads, the death toll from the fire was disproportionately high due to a mixture of lack of law enforcement and tactical errors on the day of disaster. The strong winds empowered the fire which moved quickly towards human settlements leaving little time to respond. Once the fire reached the settlements of Neos Voutzas and Mati the population ran towards the sea but the topographical peculiarities of the Mati settlement, mainly due to illegal constructions without any urban planning, rendered it into a trap. Errors were made by almost every party involved: the Fire Brigade, preoccupied with another fire in the region, initially underestimated the wildfire; the local, regional and central authorities failed to alert the population; the Police made grave mistakes in traffic control; the Coast Guard came too late to save the people who had found refuge in the sea.

In the aftermath, government and opposition were involved in a blame game. While originally the declarations of the government to fight illegal building practices were promising, their attempts gradually weakened. Academics and experts have called for the reform of the Civil Protection mechanism, but so far no media has reported on any progress.

However, the issue of learning needs to be seen in a more nuanced way. On the one hand, the logic of political competition hinders sustainable learning processes. On the other hand, learning does take place if counterproductive politicisation can be avoided. In the Summer of 2023, large wildfires broke out again in northeastern Greece, even more extensive than the July 2018 wildfires in terms of the area of forest destroyed. More than 80 wildfires were recorded in 2023, counting only those that could not be extinguished within a short period of time. Once again, the political blame has been placed on one side. The left-wing Syriza party, which had been the governing party in 2018, was now in opposition and accused

the conservative coalition government led by Prime Minister Kyriakos Mitsotakis of serious failures in fire prevention and the organisation of rescue services. As a matter of fact, though, the forest fires of 2023 claimed far fewer victims than those of 2018 (35 deaths according to Lampridi, 2023). Local authorities and fire brigade representatives explained this by saying that the fire brigade had focused strictly on protecting residential areas and infrastructure. Another factor was the very rapid mobilisation of international assistance. No fewer than 14 countries sent hundreds of firefighters to Greece, and several provided firefighting aircraft and other technical equipment within days ("What lessons can Greece learn from this year's raging wildfires?", 2023). There is no doubt that the shock of July 2018 was deeply felt, certainly an explanatory factor when it comes to the determined and strictly focused fight against the wildfires in the summer of 2023.

However, the learning effects did not extend to the crucial dimension of structural prevention. This concerns, on the one hand, the restructuring of the biosphere, that is, the systematic reduction of the biostructural components of the ignition and, above all, the spread of forest fires. On the other hand, it concerns the enforcement of legislation to protect buildings and residential areas against fire, the lack of which proved fatal in the Mati disaster in July 2018. While measures to restructure the forest biosphere will inevitably take some time without being socially or politically controversial, the enforcement of existing or newly conceived legislation to restructure settlement and housing areas faces precisely the complexly structured resistance described in the other chapters of this book, including the introduction, as a multi-stakeholder phenomenon, which is characteristic of the actual policy challenge.

References

A. Tsipras: Analambano akeraia tin politiki eythyni gia tin tragodia [A. Tsipras: I fully assume political responsibility for the tragedy]. (2018, July 27). *CNN Greece*. https://www.cnn.gr/news/politiki/story/140469/a-tsipras-analamvano-akeraia-tin-politiki-eythyni-gia-tin-tragodia

Allos enas nekros vrethike sto oikopedo tis frikis sto Mati: 84 ta thymata [One more dead found in the plot of horror in Mati: 84 victims now]. (2018, July 26). *Proto Thema*. https://www.protothema.gr/greece/article/808342/alert-alloi-duo-nekroi-vrethikan-sto-oikopedo-tis-frikis/

Apografi plithismou-katoikion 2021. Oikonomika energos kai mi energos plithysmos, apascholoumenoi kata tomea oikonomikis drastiriotitas, anergoi. Dimotikes koinotites [Population and Housing Census 2021. Economically active and inactive population, employed by sector of economic activity, unemployment. Municipal communities, *Elliniki Statistiki Archi (Hellenic Statistical Authority)*, Γ04 (2021).

Authaireta: Xekinise i katedafisi ton proton 22 ktismaton stin Athinon-Souniou [Unauthorized constructions: The demolition of the first 22 buildings on Athens-Sounio Avenue]. (2018, August 30). *Newsbomb*. https://www.newsbomb.gr/ellada/story/912137/aythaireta-xekinise-i-katedafisi-ton-proton-22-ktismaton-stin-athinon-soynioy-pics

Dasikes pyrkagies: To 2021 kaikan tosa stremmata stin Ellada osa kata tin oktaetia 2013–2020 [Forest fires: As many hectares burned in Greece in 2021 as in the eight years 2013–2020]. (2022, January 4). *Proto Thema*. https://www.protothema.gr/greece/article/1197803/dasikes-purkagies-to-2021-kaikan-tosa-stremmata-stin-ellada-osa-kata-tin-oktaetia-20132020/

Diki Mati: Eleutheroi oi exi katadikasthentes – Poines "xadi" tou dikastiriou [Mati Trial: Six convicts freed – Court's "caress" sentences]. (2024, April 29). *CNN Greece*. https://www.cnn.gr/ellada/story/417088/diki-mati-apo-triaeos-111-xronia-stous-katigoroymenous-eksagorasimes-oi-poines

Egklisi enopion tou k. Eisaggeleos Plhmmeleiodikon Athinon [Indictment before the Prosecutor of Athens]. (2018, August 1). *Enikos.gr*. http://media.enikos.gr/data/files/587632_8bc5be1ce4-841c15ace73d6813.pdf

Fotia Attiki: To porisma tis Perifereias 'kaiei' tin Pyrosbestiki [Attica fire: The findings of the Regional Government 'burn' the Fire Brigade]. (2018, August 10). *CNN Greece*. https://www.cnn.gr/news/ellada/story/142144/fotia-attiki-to-porisma-tis-perifereias-kaiei-tin-pyrosvestiki

Fotia Mati: Xepernoun tis archikes ektimiseis oi apozimioseis ton pligenton [Mati wildfire: The compensations exceed initial estimations]. (2018, September 13). *CNN Greece*. https://www.cnn.gr/news/ellada/story/146640/fotia-mati-xepernoyn-tis-arxikes-ektimiseis-oi-apozimioseis-ton-pligenton

Fotia sto Mati: Ayti einai i lista ton nekron [Mati wildfire: Here is the list of the fatalities]. (2018, August 9). *Proto Thema*. https://www.protothema.gr/greece/article/811727/fotia-sto-mati-auti-einai-i-lista-ton-nekron/

Georgiou, E. (2023, July 23). Mati 23 Iouliou 2018: I ethniki tragodia kai to 'giati' pou kapnizei akomi… [Mati 23th of July 2018: The national tragedy and the 'why' which is still burning…]. *Ta Nea*. https://www.tanea.gr/2023/07/23/greece/mati-23-iouliou-2018-i-ethniki-tragodia-kai-to-giati-pou-kapnizei-akomi/

Goldammer, J.G., Xanthopoulos, G., Evtichidis, G., Mallinis, G., Mitsopoulos, I., & Dimitrakopoulos, A. (2019). *Report of the Independent Committee established with the Decision of the Prime Minister Υ60 (Government Gazette 3937/B/2018) tasked to analyze the underlying causes and explore the perspectives*

for the future management of landscape fires in Greece. The Global Fire Monitoring Center (GFMC). https://www.hellenicparliament.gr/UserFiles/8158407a-fc31-4ff2-a8d3-433701dbe6d4/Y60_COMMITTEE_LANDSCAPE%20FIRE_FULL%20REPORT_GREECE.pdf

Gourmpatsis, A. (2020, October 07). Apologismos pyrkagion, etous 2020 [Fire report 2020]. *dasarxeio.com*. https://dasarxeio.com/2020/10/07/87269/

Gourmpatsis, A. G. (2018, August 17). Techniki ekthesis (prokatarktiki) [Technical report (preliminary)]. *Naftemporiki*. https://www.naftemporiki.gr/documents/1383370/tragodia-sto-mati-porisma-fotia-gia-lathi-kai-paraleipseis

Gourmpatsis, A. G. (2023, September 4). Enas synolikos apologismos ton pyrkagion tou 2023 [a sum report of fires in 2023]. *Huffpost.*. Retrieved from https://www.huffingtonpost.gr/entry/enas-senolikos-apoloyismos-ton-perkayion-toe-2023_gr_64f4fae4e4b01b2fe4b66e77

Greek wildfires: Drivers 'sent into path of blaze by police' (2018, August 1). *BBC News*. https://www.bbc.com/news/world-europe-45030082

Hatzidakis: De tha symbibastoume me tin authairesia [Hatzidakis: We will not compromise with arbitrariness]. 2020, June 19). *Newsbomb*. https://www.newsbomb.gr/politikh/story/1092708/xatzidakis-den-tha-symvivastoyme-me-tin-aythairesia

Hood, C. (2001). *The blame game: Spin, bureaucracy, and self-preservation in government*. Princeton University Press.

I apokatastasi sto Mati [Restorations in Mati]. (2018, August 1). *The Fact*. https://thefact.gr/2018/08/01/i-apokatastasi-sto-mati-i-perioxi-exei-reuma/

I deyteri pio foniki pyrkagia ston 21o aiona pagkosmios [The second deadliest wildfire in the 21st century worldwide]. (2018, July 25). *I Efimerida ton Syntakton*. http://www.efsyn.gr/arthro/i-deyteri-pio-foniki-pyrkagia-ston-21o-aiona-pagkosmios

Karatziou, N. (2023, August 7). Dasikes pyrkagies: Ti pigainei toso lathos? [Forest fires: What goes so wrong?]. *Lifo*. https://www.lifo.gr/stiles/optiki-gonia/dasikes-pyrkagies-ti-pigainei-toso-lathos

Karatziou, N. (2024, January 23), Pos kamia kyvernisi den tolma na gremisei ta authaireta (ki ekeina pollaplasiazontai) [How no government dares to demolish the arbitrary buildings (and they are multiplying)]. *Lifo*. https://www.lifo.gr/stiles/optiki-gonia/giati-den-katedafizontai-ta-aythaireta-stin-ellada

Kolafos to porisma ton eisaggeleon gia to Mati – To apolyto chaos kata ti diarkeia tis pyrkagias [Slapping findings of the persecutors about Mati – Absolute chaos during the fire]. (2019, March 6). *OtaVoice*. https://www.otavoice.gr/politiki/2019/03/kolafos-to-porisma-ton-eisaggeleon-gia-to-mati-to-apolyto-xaos-kata-ti-diarkeia-tis-pyrkagias/

Koukakis, T. (2018, July 26). To 85% ton katoikion stin Ellada den echei asfaleia enanti pyrkagion [85% of residences in Greece do not have insurance against fire]. *CNN Greece*. https://www.cnn.gr/oikonomia/story/140228/tetarth-to-85-ton-katoikion-stin-ellada-den-exei-asfaleia-enanti-pyrkagion

Kyma allileggyis apo to exoteriko pros tin Ellada [A wave of solidarity from abroad to Greece]. (2018, July 24). *Kathimerini*. http://www.kathimerini.gr/976567/article/epikairothta/ellada/kyma-allhleggyhs-apo-to-e3wteriko-pros-thn-ellada

Lampridi, F. (2023, August 23). Foties 2023: Ypotimontas tous nekrous, tis katastrofes kai ti noimosyni mas [Wildfires 2023: Underestimating the dead, the disasters and our intelligence]. *Tvxs*. https://tvxs.gr/apopseis/arthra-gnomis/foties-2023-ypotimontas-toys-nekroys-tis-katastrofes-kai-ti-noimosyni-mas/

Lekkas, E., Carydis, P., Lagouvardos, K., Mavroulis, S., Diakakis, M., Andreadakis, E., Gogou, M. E., Spyrou, N. I., Athanassiou, M., Kapourani, E., Arianoutsou, M., Vassilakis, M., Parcharidis, P., Kotsi, E., Speis, P. D., Delakouridis, J., Milios, D., Kotroni, V., Giannaros, T., Dafis, S., Kargiannidis, A., & Papagiannaki, K. (2018). The July 2018 Attica (Central Greece) wildfires - Scientific report (Version 1.0.). *Newsletter of Environmental, Disaster, and Crisis Management Strategies, 8*. https://edcm.edu.gr/images/docs/2018/Newsletter_Attica_Fires_2018_v11.pdf

Lialios, G. (2019, October 31). Oi ligoteres pyrkagies tis dekaeties to 2019 [The fewest wildfires of the decade in 2019]. *Kathimerini*. https://www.kathimerini.gr/society/1049556/oi-ligoteres-pyrkagies-tis-dekaetias-to-2019/

Mandrou, I. (2018, November 22). Arneitai kathe eythyni gia ti foniki pyrkagia sto Mati i Rena Dourou [Rena Dourou denies responsibility for the deadly fire in Mati]. *Kathimerini*. http://www.kathimerini.gr/996528/article/epikairothta/ellada/arneitai-ka8e-ey8ynh-gia-th-fonikh-pyrkagia-sto-mati-h-rena-doyroy

Mandrou, I. (2019, March 07). Eisaggeliko porisma gia to Mati: Apolyti i anyparxia kratikou michanismou [Prosecutorial findings about Mati: Complete absence of the state mechanisms]. *Kathimerini*. http://www.kathimerini.gr/1013485/gallery/epikairothta/ellada/eisaggeliko-porisma-gia-to-mati-apolyth-h-anypar3ia-kratikoy-mhxanismoy

Markopoulos, D. (2018, August 14). €500 ekat. oi apozhmioseis gia tin pyrkagia sto Mati [The compensations for the Mati fire reach €500 million]. *newmoney.gr*. https://www.newmoney.gr/palmos-oikonomias/366924-%E2%82%AC500-ekat-oi-apozimioseis-gia-tin-pirkagia-sto-mati

Mast, M. (2018, July 24). Waldbrände in Griechenland: "Der tödlichste Faktor ist der Wind". *Die Zeit*. https://www.zeit.de/wissen/umwelt/2018-07/waldbraende-griechenland-athen-lindon-pronto-feuer-klima

Mati: 13 apo tous 99 nekrous pnigikan sti thalassa [Mati: 13 out of the 99 dead drowned in the sea]. (2018, October, 22). pagenews.gr. https://www.pagenews.gr/2018/10/22/ellada/mati-13-apo-tous-99-nekrous-pnigikan-sti-thalassa/

Mati: Katelixe alli mia egkavmatias – 104 ta thymata apo ti foniki pyrkagia [Mati: Another burn victim ends up dead - 104 victims of the deadly fire] (2022, October 10). *Proto Thema*. https://www.protothema.gr/greece/article/1294335/mati-katelixe-alli-mia-egaumatias-104-ta-thumata-apo-ti-foniki-purkagia/

Mati: Ta onomata ton 102 nekron sti foniki pyrkagia [Mati: The names of the 102 dead in the deadly fire]. (2021, July 23). *I Efimerida*. https://www.iefimerida.gr/ellada/mati-ta-onomata-ton-102-nekron-sti-foniki-pyrkagia

Mayraganis, K. (2016, August 4). Ta grafimata ton pyrkagion: Stoicheia gia tis dasikes foties apo to 2000 eos to 2015 [Wildfire graphs: Data about forest fires from 2000 until 2015]. *Huffington Post Greece*. https://www.huffingtonpost.gr/2016/08/04/grafhmata-pyrkagies_n_11292464.html

Moustaka, M. (2019, March 06). Kolafos to porisma ton eisaggeleon gia to Mati – To apolyto chaos kata ti diarkeia tis pyrkagias [The slapping findings of the prosecutors about Mati – Absolute chaos during the fire]. *in.gr*. https://www.in.gr/2019/03/06/greece/kolafos-porisma-ton-eisaggeleon-gia-mati-kathysteriseis-kai-elleipsi-sxediou/

Oi poines gia tin pyrkagia sto Mati - I apofasi tou Dikastiriou [The sentences for the Mati fire - The Court's decision]. (2025, June 4). *I naftemporiki*. https://www.naftemporiki.gr/society/1964671/oi-poines-gia-tin-pyrkagia-sto-mati-i-apofasi-toy-dikastirioy/

Papazoglou, N. (2018, July 25). Fotia sto Mati: Apisteyti tyxi - Kleidothikan sto spiti, to sfragisan kai glitosan [Mati wildfire: Incredible luck - They locked themselves in the house, they sealed it, and they were spared]. *I Efimerida*. https://www.iefimerida.gr/news/433334/fotia-sto-mati-apisteyti-tyhi-kleidothikan-sto-spiti-sfragisan-kai-glitosan-vinteo

Paraitisi Psinaki zitoun 23 apo tous 30 dimotikous symboulous [23 out of 30 municipal councilors demand Psinakis' resignation] (2018, July 30). *Ta Nea*. https://www.tanea.gr/2018/07/30/greece/paraitisi-psinaki-zitoyn-23-apo-toys-30-dimotikoys-symboyloys/

Paraitithike kai dimotiki symboulos ston Marathona – Egkataleipoun ton Psinaki kai zitoun tin paraitisi tou [Another municipal councilor of Marathon resigned – They abandon Psinakis and demand his resignation] (2018, July 28). *Lifo*. https://www.lifo.gr/now/greece/202272/paraitithike-kai-dimotiki-symvoylos-ston-marathona-egkataleipoyn-ton-psinaki-kai-zitoyn-tin-paraitisi-toy

Piller, T. (2018, July 25). Katastrophe nahe Athen - Tragen die Gläubiger eine Mitschuld? *Frankfurter Allgemeine Zeitung*. https://www.faz.net/aktuell/wirtschaft/braende-in-griechenland-sind-die-glaeubiger-mitschuld-15707993.html

Porisma gia Mati: Oi tilefonikes epikoinonies pou apokalyptoun to chaos [Mati findings: The phone communications that reveal the chaos]. (2019, March 07). tvxs.gr. https://tvxs.gr/news/ellada/porisma-gia-mati-oi-tilefonikes-epikoinonies-poy-apokalyptoyn-xaos

Press Office. (2024, January 10). Th. Skylakakis: Fernoume systima entopismou kai katedafisis olon ton neon authaireton [Th. Skylakakis: We are bringing an identification and demolition system for all new unauthorized buildings]. *Ministry of Environment and Energy*. https://ypen.gov.gr/th-skylakakis-fernoume-systima-entopismou-kai-katedafisis-olon-ton-neon-afthaireton/

Psinakis gia Mati: Os dimarchos Marathona ekana to kathikon mou [Psinakis for Mati: I fulfilled my duties as Mayor of Marathon]. (2018, November 21). *CNN Greece*. https://www.cnn.gr/news/ellada/story/155522/psinakis-gia-mati-os-dimarxos-marathona-epitelesa-to-kathikon-moy

Rakintzis, L. T. (2020, June 16). Katedafiseis authaireton mia pikri istoria [Demolition of unauthorized structures, a sad story]. *Huffington Post Greece*. https://www.huffingtonpost.gr/entry/katedafiseis-aethaireton-mia-pikre-istoria_gr_5ee8652dc5b68761e03d84ce

Sharman, J. (2018, July 25). Greece wildfires latest: European countries send fire-fighting planes amid desperate attempts to stop deadly blazes spreading. *Independent*. https://www.independent.co.uk/news/world/europe/greece-wildfires-latest-athens-dead-updates-europe-firefighting-planes-canadair-a8462496.html

Skrepetos, A. (2018). *Statistiki analysi megalon dasikon pyrkagion stin Ellada [Statistical analysis of great forest fires in Greece]*. Master dissertation. Charokopeion University. http://estia.hua.gr/file/lib/default/data/20229/theFile

Souliotis, G. (2018, July 29). To chroniko tis ethnikis tragodias [The timeline of the national tragedy]. *Kathimerini*. http://www.kathimerini.gr/977325/interactive/epikairothta/ereynes/to-xroniko-ths-e8nikhs-tragwdias

Souliotis, G. (2018b, August 9). Emprismos apo ameleia i fotia pou stoichise ti zoi se 92 anthropous [Negligent arson was the origin of the fire that killed 92 people]. *Kathimerini*. http://www.kathimerini.gr/979078/article/epikairothta/ellada/emprhsmos-apo-ameleia-h-fwtia-poy-stoixise-th-zwh-se-92-an8rwpoys

Spirtzis: Gia tin pyrkagia ftaiei i anarchi domisi kai oi poleodomikes parabaseis [Spirtzis: Anarchic building and the violations of city planning are responsible for the wildfire] (2018, July 26). *Kathimerini*. http://www.kathimerini.gr/976974/article/epikairothta/politikh/spirtzhs-gia-thn-pyrkagia-ftaiei-h-anarxh-domhsh-kai-oi-poleodomikes-paravaseis

Stoixeia gia ta aythaireta sto Mati dinei to Techniko Epimelitirio Elladas [The Technical Chamber of Greece releases data for the illegal buildings at Mati] (2018, July 27). *I Efimerida*. https://www.iefimerida.gr/news/433985/stoiheia-gia-ta-aythaireta-sto-mati-dinei-tehniko-epimelitirio-elladas

Synolakis, C. (2018, July 25). Mistakes and oversight. *Kathimerini*. http://www.ekathimerini.com/231040/opinion/ekathimerini/comment/mistakes-and-oversights

Synolakis, C. et al. (2018, August 13). Perilipsi apo ta symperasmata tis meletis gia tin ethniki tragodia stin Anatoliki Attiki kai tin anamorfosi tis politikis prostasias [Summary of the conclusions of the study on the national tragedy in East Attica and the reformation of the civil protection service]. *newpost.gr*. http://newpost.gr/storage/files/uploads/for-profces-execsummary.docx

To oikopedo tis frikis [The field of horror]. (2018, July 25). *I Efimerida*. https://www.iefimerida.gr/news/433315/oikopedo-tis-frikis-edo-vrethikan-nekroi-agkaliasmenoi-oi-25-sto-mati-eikones-vinteo

Toskas: Ypevalla paraitisi alla den egine dekti [Toskas: I submitted my resignation but it was not accepted]. (2018, July 26). in.gr. https://www.in.gr/2018/07/26/politics/kyvernisi/toskas-sovares-endeikseis-gia-emprismo-stis-pyrkagies-tis-attikis/

Triantafillidou, A., & Yannas, P. (2022). Coping with natural disasters: Political leadership framing of the wildfires in Greece. *Journal of Contingencies and Crisis Management, 31*(2), 212–225.

Tsipras: Anelabe tin politiki eythyni gia tin tragodia, den zitise syggnomi gia tous nekrous [Tsipras: He assumed the political responsibility for the tragedy, but did not apologize for the dead]. (2018, July, 27). *Ta Nea*. https://www.tanea.gr/2018/07/27/politics/tsipras-anelabe-tin-politiki-eythyni-gia-tin-tragwdia-den-zitise-syggnwmi-gia-toys-nekroys/

What lessons can Greece learn from this year's raging wildfires? (2023, September 8). *Euronews*. https://www.euronews.com/2023/09/08/what-lessons-can-greece-learn-from-this-years-raging-wildfires

WWF Ellas: Ta oikonomika tis prolipsis kai tis katastolis ton dasikon pyrkagion [WWF Greece: Economics of forest fire prevention and suppression] (2022, May 14). dasarxeio.gr. https://dasarxeio.com/2022/05/14/112010/

Xena MME: Ftaiei i litotita gia ti fotia? [Foreign Media: Is austerity to blame for the wildfire?] (2018, July 26). *I Efimerida*. https://www.iefimerida.gr/news/433723/xena-mme-ftaiei-i-litotita-gia-ti-fotia

Xypnitou, M. (2018, September 16). Freno stis katedafiseis – Ston "aera" ta dasika aythaireta [Stop to demolitions – Forestal illegal buildings pending]. *Eleytheros Typos*. https://www.eleftherostypos.gr/ellada/292741-freno-stis-katedafiseis-ston-aera-ta-dasika-aythaireta/

YPEN: Katedafisi 16 authaireton akiniton se aigialous, paralies, dasikes ektaseis [Ministry of Environment: Demolition of 16 illegal buildings on coastlines, beaches and forest areas]. (2023, November 1). *Naftemporiki*. https://www.naftemporiki.gr/green/climate/1531665/ypen-katedafisi-16-aythaireton-akiniton-se-aigialoys-paralies-dasikes-ektaseis/

CHAPTER 4

Amenity Traps and Safety Illusions: The California Camp Fire of 2018

Wolfgang Seibel

4.1 Introduction

The California Camp Fire, raging November 8–23, 2018, and named after Camp Creek Road in Butte County where the fire started, was the most destructive wildfire in California's history. It claimed the lives of 86 people, burned 153,336 acres of land, and destroyed 18,739 structures (homes and official buildings). The towns Paradise and Concow were destroyed to 95%. Paradise in particular, a town of some 26,000 inhabitants, became the symbol of the destruction and the loss of human life (cf. Gee & Anguiano, 2020, for a first comprehensive account, as well as Blunt, 2022, and, especially, the relevant reports issued by the US National Institute of Standards and Technology, NIST, 2021, 2023). Yet, the wildfire itself, even if not one of such dimensions, was predictable (cf. Turco et al., 2023). According to the California Department of Forestry and Fire Protection criteria, the towns of Paradise and Concow were located in a Very High Fire Hazard Severity Zone (VHFHSZ) (NIST, 2021, p. 12). Yet, existing risk analyses and expert opinions had not been taken seriously

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enough by relevant corporate, political, and administrative actors. In particular, the analysis of the immediate origin of the campfire and the culpability of California's main electric energy supplier, Pacific Gas and Electric Company (PG&E), performed by a Butte County Grand Jury in its Camp Fire Public Report (CFPR, 2020), reveals the paradox of corporate inspection guidelines, formal compliance, risk awareness, on the one hand, and actual negligence and safety illusions, on the other.

While the Camp Fire Public Report of the Butte County Grand Jury focused on corporate responsibility, the research conducted under the auspices of the US National Institute of Standards and Technology was mainly descriptive in nature. As such, however, it represents a documentation of utmost diligence and accuracy (cf. NIST, 2021, 2023; cf. Link & Maranghides, 2024, for a concise overview). Especially, the first of the reports (modestly entitled "case studies") on the Fire Progression Timeline and the fourth report on Notification, Evacuation, Traffic, and Temporary Refuge Areas (NETTRA) are of particular relevance. The report under the headline "Fire Progression Timeline" (NIST, 2021) analysed the spread of the fire almost minute by minute on the very day of the disaster, November 8, 2018. The report on Notification, Evacuation, Traffic, and Temporary Refuge Areas (NIST, 2023), by contrast, addressed the decisive issue of saving as many human lives as possible. It is therefore a particularly impressive document.

Neither of the official reports, however, addressed public accountability issues and related sustainable learning prospects, although the NIST "case studies" came up with expanded lists of recommendations (NIST, 2021, pp. 154–155; 2023, pp. 40, 71, 173–174, 215). While negligence and insufficient infrastructure maintenance on the part of PG&E represented the cause of the ignition of the Camp Fire, the devastating impact on the cities of Paradise and Concow could have been mitigated if recommendations for improved safety measures made by a previous Butte County Grand Jury after the Humboldt Fire of June 2008, issued in 2009, would have been fully implemented. However, some recommendations such as imposing a moratorium on new homes in fire-prone areas or to widen potential escape routes collided with the perceived interest of the local constituency in affordable housing and community-friendly neighbourhoods.

So one might infer that the Camp Fire Public Report of 2020 had a manifest and a latent function. The manifest function was to hold PG&E accountable for what it was actually responsible for and to ensure enforceable liability. This was of pivotal importance since PG&E's liability implied

financial compensations indispensable for the recovery of the communities destroyed by the fire. At the same time, the Camp Fire Public Report facilitated blame shifting. After all, no report of similar diligence was initiated in an attempt to untangle the complex causal web that resulted in a paradox of risk awareness solidly embedded in a local community and the omission to perform well-defined risk mitigating measures in accordance with the recommendations of the Butte County Grand Jury of 2009. This leads to the more fundamental question of how community life and safety illusions are interconnected to an extent that may result in counterproductive behavioral patterns of private and public actors when it comes to natural hazard risk mitigation.

4.2 Social Cohesion and Natural Hazard Vulnerability

The connection between the social fabric and vulnerability to natural hazards and the pursuit of resilience is undisputed in principle. What is subject to rival paradigms of interpretation, however, is the logic and the causal direction of the linkage itself. Prior and Eriksen (2013) stated that what they called "community cohesion" is a prerequisite of strategic resilience and a sustainable neutralisation of risks connected to natural hazards (cf., in a similar vein, Aldrich, 2012; Hackerott, 2022; Jerolleman, 2022). Prior and Eriksen concluded that "a sense of community and collective problem-solving contribute to self organisation and effective response to hazard risks" (ibid., p. 1583) as soon as "wildfire preparation becomes the norm in the community rather than the exception" (ibid.). After all, shared values and a spirit of a collective purpose are a powerful resource when it comes to problem-solving of any sort. Moreover, the traditional perspective on social vulnerability to natural hazards emphasises the exposure of low-income groups (cf. Cutter & Finch, 2008, and the more recent debate on "disaster justice"; cf. Lukasiewicz & Baldwin, 2020). Wildfires, however, typically threaten habitats in the Wildland Urban Interface (WUI) where middle-class neighborhoods are also, if not primarily, affected.

A closer analysis of the relationship between community life and hazard risk response therefore reveals a more ambivalent effect of community cohesion on wildfire preparedness and risk reduction. This pertains to what Lawson and Smith (2023) call the "Amenity Trap" in a paper with the indicative subtitle "How High-Amenity Communities Can Avoid

Being Loved to Death." Although the authors primarily refer to the adverse effects of touristic attractiveness, they also address the inherent tension between the quest for amenity in local communities and increased exposure to natural hazards. Living close to the green belt around urban centres with wood and undergrowth as potential fuel for wildfires or settlements close to lakes and rivers that potentially cause flooding are classic constellations in this respect. Even risk-conscious policies may turn out to be counterproductive. As Olson et al. (2020) point out, "[C]ertain mitigation policies and programmes can have the opposite effect if the magnitude or severity of a hazard event exceeds its expected range. For example, retro-fitting and government-subsidised insurance programmes may, in fact, set up communities for catastrophe because the measures may attract people and investment to hazard-prone areas (increasing their exposures) and create a false sense of security" (ibid., pp. 04020014–5, with reference to Burby, 2006).

The question remains which of the two potentially logics that link social cohesion to natural hazard vulnerability or preparedness prevails in reality. Social cohesion and a sense of community can both stimulate risk-increasing and risk-reducing behavior in local communities. It may impede or strengthen the resolve to act collectively in the interest of protecting local habitat and human lives—or do both concurrently. In this chapter, the California Camp Fire of November 2018 is described and analysed in the attempt to demonstrate the crucial role of corporate governance of infrastructure management and of politics and governmental action as catalytic components of those alternative logics.

4.3 Too Bad to Be True? The Butte County Camp Fire Public Report of 2020

On June 16, 2020, the office of the Butte County District Attorney in California issued a report on the immediate origins of the Camp Fire. The "Camp Fire Public Report" (henceforth CFPR) with the subtitle "Summary of the Campfire Investigation" issued by the District Attorney's office of Butte County was a single purpose document. It focused exclusively on the liability of the Pacific Gas & Electricity Company (PG&E) whose weary infrastructure had led to the ignition of the wildfire. The report was based on the findings of an "Investigatory Grand Jury," a quasi-judicial body constituted on March 25, 2019. The Jury consisted of

19 Butte County citizens, assisted by prosecutors of both the DA's office and the office of the California Attorney General. The group was joined by a team of "Origin and Cause Investigators from around California" (CFPR, p. 9), hired and assigned by the California Department of Forestry and Fire Protection, also known as Cal Fire (ibid.).

The Grand Jury was tasked with an investigation into the technical arson caused by a high-voltage overhead power line, the so-called Caribou-Palermo line according its start and end point, attributed to poor maintenance and general negligence by PG&E. Preliminary evidence indicated that a simple but crucial component of the power line in question, a so-called C hook supporting part of the power line itself, had been broken in the early morning of November 8, 2018, so that the 115 kV (kilo Volt) power line touched a steel tower with the consequence that molten metal fell onto the grass and brush below which was, according to all evidence, what ignited the wildfire.

While the diagnosis itself remained uncontested from the very outset, the investigation of the Grand Jury in fifteen months of almost uninterrupted research laid bare the fact that PG&E had neglected its legal and professional obligation to properly maintain and service its assets for years, if not decades. The executive summary of the Camp Fire Public Report of June 2020 explicitly referred to "criminal negligence" (CFPR, p. 4). Indeed, the Grand Jury's task and work was strictly focused on—or limited to—the responsibility of PG&E and acts or omissions that qualified as felonies under criminal law.

The findings of the Grand Jury were devastating in their own right. As far as the initial ignition of the fire was concerned, the investigators confirmed electrical arcing between a part of the power line and the steel structure of one of the towers buttressing the power line (Tower 27/222) and the spread of molten metal as the decisive trigger. A second group of investigators analysing the ignition of what had been termed Camp Fire B found out that this particular fire had been ignited when a diseased pine tree toppled over and broke an energised distribution line. While the condition of the broken C hook upholding the power line could and should have been recognised by PG&E inspectors, the condition of the diseased tree, according to the judgment of a consulted arborist, "would have been discoverable [only] by an advanced inspection" (CFPR, p. 10). The two fires, the original Camp Fire and the so-called Camp B Fire, merged the very morning of November 8, 2018.

The Grand Jury also made an attempt to determine the technical history of the Caribou-Palermo transmission line. It had been constructed between 1919 and 1921 and was owned by PG&E since 1930. The investigators under the auspices of the Grand Jury found out that crucial components of the power line, including the section responsible for the ignition of the Camp Fire, had not been replaced since. Parts such as conductors, insulators, and attachment hardware had not even been catalogued by the company. According to the records of PG&E, the insulator attached to the so-called C hook that broke on November 8, 2018, "was an original 1921 insulator" (CFPR, p. 19). Due to lack of documentation, PG&E itself "had little or no information about the 97-year-old conductor and the hooks, original hanger holes and bolted-on hanger hole plate supporting that conductor" (ibid.). However, the investigators also found out that PG&E must have been nonetheless aware of the worn condition of transmission towers and their various components since crucial parts such as bolted-on hanger plate holes and jumper wires had been selectively replaced or moderated (CFPR, pp. 20–21). None of these repairs had been documented though, so it was unknown when and why they had been performed, let alone the question of general maintenance, grid reliability and related record keeping. Which, in the judgment of the investigators, was just another indicator of PG&E's negligence and insufficient safety culture.

Consequently, PG&E's inspection and patrol policies themselves were assessed by the investigators. The relevant regulation was General Order (GO) 165 of the California Public Utilities Commission (CPUC). Section IV of GO 165 pertains to inspections and maintenance. In formal compliance with GO 165 PG&E issued its own "Electric Transmission Preventive Maintenance Manual" (ETPM) in 2005 (CFPR, p. 23). It stated: "Inspection and patrol procedures are a key element of the preventive maintenance programme. The actions recommended in this manual reduce the potential for component failure and facility damage and facilitate a proactive approach to repairing or replacing identified, abnormal components" (cited in CFPR, p. 23). Since decades, such maintenance manuals, previously known as "Bulletins," explicitly mentioned "worn hardware and connectors" as one of the "conditions to be noted when patrolling lines" (ibid.). This also applied to the very C hook whose worn-out condition caused the ignition of the Camp Fire on November 8, 2018. What is more, it turned out that back in 1987 a PG&E Laboratory Test Report documented "a worn C hook and hanger hole from a Bay Area

transmission tower" and, as the Camp Fire Public Report continues, even "photos of the worn C hooks and holes were distributed to troublemen [unofficial language for inspectors] in all of the PG&E regions for training purposes, and inspection of C hooks and hanger holes was made a specific priority during inspections/patrol" (CFPR, p. 24). This implied that PG&E as a corporation had the most accurate knowledge about the infrastructural risk zones down to the level of individual components and took care, at least in the late 1980s, that inspections were performed accordingly.

What was a thorough and rigid inspection policy, at least on paper, became diluted in the mid-1990s when the existing protocol was replaced by a new guideline, known as "ES Guideline," issued in 1995. The guideline now differentiated inspections from patrols which basically meant that the frequency and thoroughness of the more detailed inspections were "drastically reduced" (CFPR, p. 24). The consequences were drastic indeed. The frequency of inspections of the Caribou-Palermo power line was reduced from three per year to one ground inspection and one aerial inspection in a period of two years. The previously required routine climbing inspections were entirely eliminated. Climbing inspections were only to be performed under particular "trigger" conditions (ibid.). Only "critical" 500 kV (kilo Volt) structures were subject to climbing inspections every three years and when triggered (CFPR, p. 61). Which, accordingly, did not apply to the 115 kV Caribou-Palermo transmission line whose failure ignited the Camp fire on November 8, 2018.

In 2005, the 1995 guidelines were replaced by the "Electric Transmission Preventive Maintenance Manual" (ETPM) (see above). The ETPM also differentiated inspections versus patrols with patrols confined to visual observation of the electric facilities without the use of measuring devices, tools, or diagnostic tests (CFPR, pp. 24–25). The frequency of inspections was one more time reduced to once every five years and one patrol per year in non-inspection years (CFPR, p. 25).

A private consultancy firm, Quantum Technologies, was hired in 2012 for reviewing PGE's standards and practices of inspections and patrols of overhead transmission power lines (CFPR, p. 26). What could have been a careful assessment of the actual practice of inspections and patrols was limited to a mere evaluation of the ETPM guidelines as such which, according to Quantum Technologies, were "found to be a comprehensive, well written document that adhere to its purpose to ensure uniform and consistent required procedures for patrols, inspections, equipment testing, and condition assessment of electric transmission line facilities"

(quoted after CFPR, p. 26). The investigators of the Butte County Grand Jury stated that, in reality, PG&E did "not … follow the procedures and requirements established in the ETPM" (ibid.). The jury's conclusion was "that sections of the ETPM relating to inspections and patrols of overhead electric transmission lines were simply a façade created to meet the requirements of the regulators and the CAISO [California Independent System Operator Corporation]" (ibid.).

Moreover, the Grand Jury established evidence, based on internal PG&E documentation, that the frequency of inspections and patrols was even further reduced after the issuance of the ETPM 2005. The perspective on patrols and inspections shifted explicitly from maintenance for the sake of safety to the "reduction of unit costs" (CFPR, p. 26). A list of related "Business Objectives" included the encouragement "to find efficiencies in the patrol/inspections" and to "determine frequency of patrols/inspections (are we doing more than industry standard [?])" and to "analyze current patrol/inspections work methods (i.e. crew size)" (ibid.). These were unequivocal managerial instructions to prioritise cost reduction over diligence and thoroughness of inspections and patrols. It was also evident and clearly perceivable for a corporation active in the industry for decades that the inevitable consequence was risk enhancement. Rather than incentivising accuracy and thoroughness of inspections and patrols, PG&E established a fine-grained incentive and bonus practice based on time measurement for the inspection of an individual structure or component of overhead transmission lines and close scrutiny of compliance of service personnel with the inspection and patrol budget (CFPR, p. 27).

The Grand Jury also found out that the training of inspection and patrol personnel had been de-professionalised and bureaucratised since the 1990s. While, from the mid-1980s on, PG&E guidelines entailed differentiated training programmes for so-called Transmission Troublemen, the actual troublemen training became increasingly informal and arbitrary in nature throughout the 1990s (CFPR, p. 28). In contrast to increasingly pretentious language—the initial term Troubleman was, first, replaced by the term Inspector and, subsequently, by the term Qualified Company Representative (QCR)—any formal training of QCRs was eventually abandoned (CFPR, p. 29). The Grand Jury interviewed every QCR who had inspected or patrolled the Caribou-Palermo power line that broke down and ignited the campfire on November 8, 2018. None of them had received any formal training. Instead, according to the Grand Jury, "all of

the QCRs, any inspection and patrol training was limited to filling out reporting forms and notifications for any issues identified during an inspection or patrol" (ibid.). So not only was the increasing informality of training of QCRs not compensated by individual professionalisation of inspection personnel but parallel to lower performance standards of inspections and patrols the actual qualification of inspection personnel decreased as well. Two "Detailed Ground Inspections" of the Caribou-Palermo power line performed in 2009 and 2014 "were completed by troubleman [sic] who had little or no prior transmission experience, and no formal training on performing inspections and patrols" (CFPR, p. 30). This, the Grand Jury stated, was contrary to PG&E's own Electric Transmission Preventive Maintenance Manual (ETPM), according to which QCRs/Troublemen should have been "thoroughly familiar with all of the facilities, equipment, safety rules and procedures associated with the facilities and equipment" (cited in CFPR, p. 30). The consequences were disturbing and unsurprising at the same time:

> Under the ETPM the QCRs are supposed to be looking at components and estimating wear by percentage of material lost. In order to judge material loss a troubleman would have to know what a component looked like at 100%. The majority of the troubleman [sic] sent to inspect and patrol the Caribou-Palermo line had no idea what the C hooks and hanger holes were supposed to look like. Because of their lack of knowledge, experience, and training, the troubleman could not have been expected to identify the wear. (ibid.)

What in the literature had been termed organisational myopia (Catino, 2014) was by far exceeded by PG&E's blindness. The Grand Jury's Camp Fire Public Report comes up with an entire section of individual yet typical incidences of deteriorated components of high-voltage transmission lines as a consequence of poor maintenance, failures of repair, and insufficient component replacement (CFPR, pp. 30–36). The investigators of the Grand Jury also revealed that at least two major inspections, so-called Detailed Ground Inspections conducted in 2009 and 2014, had been improperly performed and inaccurately documented (CFPR, pp. 36–43). Yet, the inspection reports had been approved and signed by the relevant PG&E supervisor (CFPR, p. 39). As a consequence, clear and unmistakable evidence of wear affecting crucial components of the power line itself and the buttressing towers, so-called triggers (of closer inspection), did

not automatically trigger thorough scrutiny as required and mandatory but were handled arbitrarily at the discretion of the individual transmission troubleman (CFPR, pp. 40–43). The Grand Jury was also able to establish evidence that even the disastrously poor inspection management concerning the Caribou-Palermo line was just the proverbial tip of the iceberg. As an independent expert retained by PG&E together with the California Public Utilities Commission (CPUC) after the Camp Fire confirmed, inspections of similar PG&E high-voltage overhead power lines were characterised by at least the same low-level performance as the maintenance management of the Caribou-Palermo power line (CFPR, pp. 44–47). This meant that PG&E's entire maintenance and inspection system was itself a key risk factor—*nota bene* in an industry for which the term "high reliable organizations" was coined in the first place. Significantly enough, a copy of the expert's report was obtained only via Grand Jury subpoena (CFPR, p. 44). With respect to the actual implementation of PG&E's Electric Transmission Preventive Maintenance Manual (ETPM) the Jury concluded:

> Although several PG&E transmission line employees referred to the ETPM as 'The Bible' and asserted strict compliance with the standards and policies of the ETPM, the totality of the evidence shows that on the Caribou-Palermo line, the ETPM was not followed. Because PG&E had inexperienced, untrained and uninformed personnel conducting inspections and patrols under unrealistic time constraints, the inspections and patrols did not spot defects and wear. (CFPR, p. 43)

Another significant detail, and a paradox at first glance, was that PG&E "had consistently increased its budget for maintenance, repair and replacement of transmission assets" (CFPR, p. 48). While the budget figures as such were indisputable, the investigation of the Grand Jury revealed that PG&E was not using the funds for effective maintenance (ibid.). Instead, according to the Grand Jury, PG&E's budget structure itself entailed counterincentives impacting on the scale and scope of inspections and patrols and related maintenance work. PG&E's budget was divided into two categories: one for "capital" and one for "expense." The "capital" budget for the electric transmission branch of PG&E was funded through customer rates while the "expense" budget was funded by the company itself (CFPR, p. 49). Inspections, patrols, and maintenance were paid from the expense budget while hardware such as replacement of electrical

transmission assets was paid from the capital budget. However, "money spent on the expense budget potentially reduced the amount of profit of the company" (ibid.). This means that the budget structure provided a further incentive to restrict maintenance expenditure and/or manipulate the definitions of maintenance requirements so that the costs could be charged to the capital budget financed via the customer tariffs (CFPR, pp. 55–56). At the same time, however, customer tariffs were of limited elasticity so that burdening customers with substantially higher maintenance costs was no option. As a Senior Director of PG&E's Transmission Asset Management (TAM) unit admitted, "TAM decisions were, in part, 'informed by the most cost-effective approach for our customers'" (cited in CFPR, pp. 60).

What further aggravated those counterproductive incentives of PG&E's budget structure was that the budget for inspection and patrol of the transmission lines was tightly controlled by PG&E's Business Finance Department. The Business Finance Department—factually and mentally remote from the actual technical and infrastructural conditions of the power lines—set up a specified budget for each of the PG&E transmission maintenance divisions (CFPR, p. 49). This was done on the basis of standardised time spans to be spent on a single structure such as a tower or pole in the course of a specific inspection. The standardised procedure not only did not take into account the technical and infrastructural specificities of the individual structures but also did not differentiate the time allocated for each inspection according to "the physical location of each structure or the time required to travel from structure to structure" (ibid.). Which created a further incentive to carry out inspections least where they were needed most. The most time-consuming and most intricate and challenging maintenance tasks were those to be performed literally in the woods where the risk of wildfires was highest. By contrast, inspections and maintenance works in the flat land or at the outskirts of urban agglomerations were relatively easy to perform and less time-consuming due to both lower risks connected to fuel of potential fire and better access conditions. In a PG&E internal mail of 2016 (no exact date available) a former Maintenance and Construction Engineer (M&C Engineer) wrote to the PG&E's Transmission Line Asset Strategist that the Caribou-Palermo power line "is in a very remote area" and that "access is very limited" (CFPR, p. 52). The Butte County Grand Jury concluded:

> Based upon the totality of the evidence, specifically the reductions in times allotted for patrol and inspection, the internal emails indicating budget reductions and the formation of a committee to investigate reducing patrol and inspection costs, the only reasonable conclusion was that PG&E achieved expense budget cost savings by reducing the thoroughness of inspections and patrols. (CFPR, p. 50)

These conditions turned out to be particularly consequential since the actual maintenance and repair controlled by PG&E's Transmission Asset Management (TAM) was planned and performed exclusively on the basis of reports from the field (CFPR, p. 59) which were, in turn, subject to systematically reduced frequency and thoroughness. Accordingly, "no consistent and comprehensive data base or policy for evaluating risk" existed (CFPR, p. 58), let alone a strategy of preventive maintenance and systemic resilience.

Hence a definition and framing of risk avoidance whose effects were counterproductive in nature. At the surface, risk reduction policy within PG&E and internal budgeting processes were sophisticated and committed to elevated professional standards. A Risk-Informed Budget Allocation system (RIBA) was introduced in 2014. Unlike what the naming of the initiative suggests, however, the definition of "risk" did not address potential infrastructural and technical failure. Instead, as one of the PG&E managers involved in the RIBA process admitted when interviewed by the Grand Jury, the focus was on customer impact (CFPR, p. 53). Accordingly, the emphasis was essentially on usual customer satisfaction standards such as absence or duration of outages, general stability of the electric grid, and potential personal injuries. Which, in turn, implied an emphasis on locations that were most densely populated and, accordingly, outside the most sensitive technical and infrastructural risk zones in forested areas. Put another way, PG&E risk assessment did not address the "nature of nature." What was defined as a WRDI (Worst Reasonable Direct Impact) was a high-voltage overhead power line or supporting structure falling down and hitting somebody (CFPR, p. 54).

Yet, the risk of technical failure of transmission and distribution lines under certain weather conditions was indeed acknowledged. As a tragic irony, however, RIBA team members defined heavy rain as the main risk factor whose presence could create conditions under which "structures would go down" (CFPR, p. 55). Which implied that, at the same time, the chance of wildfires would be minimal. This was entirely unrelated to the

otherwise sophisticated provisions of PG&E to identify "Wildfire Administrative Zones" (CFPR, pp. 68–69) which accurately identified linkage between rain seasons, rapidly growing grass and brush, and subsequent extreme drought. No consequences were drawn, however, when, in the summer and fall of 2018, precisely those conditions emerged and the risk of worn transmission lines igniting fire in parched forests and bushes should have been evident. As the Grand Jury summarised,

> [T]he evidence clearly establishes, beyond a doubt, PG&E was aware of the causal relationship between fire and equipment failure on transmission towers. The vast majority of PG&E initiated fires were caused by something (a tree, an animal, a person, the ground, or a steel structure) coming into contact with an energized conductor. The entire purpose of the electric transmission system is to move electricity from point A to point B through the conductor. The entire purpose of all of the components of the overhead transmission system, except the conductor, is to keep the conductor safely hanging in the air. Essential to keeping the conductor hanging in the air is the hardware that connects the conductor to the structure. PG&E knows that if that hardware breaks the result is a wire down event. *Despite all of this knowledge PG&E did absolutely nothing to identify and replace the worn hardware essential to keeping the conductor safely in the air*. (CFPR, p. 65 (italicisation by the author))

4.4 Self-Inflicted Vulnerability?

Impressive as the Camp Fire Public Report of June 2020 is in its accuracy and sharp judgment of PG&E's disastrous maintenance practices, it was significantly one-sided. Particularly noteworthy is the fact that the findings and recommendations of the previous Grand Jury established after the Humboldt Fire of 2008 and its report of 2009 and their disregard by both state and municipal authorities were only selectively addressed. Which indirectly reveals a counterproductive linkage between social cohesion and active community life, on the one hand, and weak and/or unenforced fire protection regulation and short-sighted urban planning, on the other hand. The issue of responsibility, let alone liability, of the California Public Utilities Commission (CPUC) as the relevant regulatory agency was not addressed as such in the Camp Fire Public Report. Moreover, the inaction with which local government agencies in Butte County had responded to the recommendations of a Grand Jury of 2009 remained undressed as well. The very acceptance of that inaction in Paradise community life is

one explanatory factor when it comes to the Jury's silence. As Eriksen and Simon (2017) emphasise, the vulnerability of middle-class and upper middle-class habitats (their example is the Oakland Hills fire of 1991) is connected to the role of homeowners as "active agents in the production and consumption of vulnerability" (ibid., 309). The question remains though what the role of what these authors call the affluence-vulnerability interface (AVI) is actually about.

The Butte County Grand Jury of 2009 had come to the conclusion that a moratorium on new homes in fire-prone areas should be put in place (GJ, 2009, R [Recommendation] 47 and 52), "until all fire safety, traffic, and emergency water supply issues are resolved." This in response to the finding that, so far, the development of new housing in fire-prone areas was at the time ongoing (ibid., R 51). Matthias Gafni of the Bay Area News Group reported, however, that the Butte County Board of Supervisors deemed the measure "not reasonable" ("Rebuild Paradise? Since 1999, 13 large wildfires burned in the footprint of the Camp Fire. The town's topography, climate and history leaves it vulnerable," *Mercury News*, December 2, 2018). Gafni's report extensively covers the experience and risk definitions of Paradise residents under the immediate physical and psychological impact of the Camp Fire. Residents were torn between a strong desire to rebuild their homes in the spirit of an active and vibrant community life and the realisation that it is precisely this life and bare survival that is at stake when it comes to deciding whether to stay or leave. One resident was quoted as saying, "For ten years I tortured myself with anticipation of what had just happened on November 8 [the day of the disaster]," and, she admitted, "I escaped effortlessly only because I was ready, I always watched the weather, the wind and slept with my windows open smelling for the smell of burning vegetation," (ibid.). This resident added that, after 45 years living in Paradise, "I want to live in Paradise. It's my home and I cannot live in a community that Paradise has become." Another resident, however, a Paradise native, affirmed that she could not "imagine living anywhere else than where her three-bedroom home built in the 1970s once stood." And she added: "I know our Town leaders personally and they were committed to revitalising Paradise before the fire, and even more now, to bring it back better than ever" (ibid.). Another resident mentioned, however, that at a post-Camp town meeting only 7 out of 60 residents who lost their homes said they would return to Paradise.

The reason why the Butte County Board of Supervisors believed to be able to consider the moratorium on new home building in fire-prone areas as "not reasonable" was invested trust in building code improvements and fire prevention requirements for new housing (ibid.). One Butte County Supervisor lost his own home in the Camp Fire along with the homes of his mother and sister. He was not on the Board though when the Supervisors rejected the recommendation of a home building moratorium made by the Grand Jury after the Humboldt Fire of 2008. He expressed what probably is a continuing pattern of hope and optimism indicating that even the much more devastating Camp Fire of 2018 had not triggered further reconsideration. Gafni quoted this resident as saying, "I feel it's defendable [to stay and to rebuild] and the reconstruction will be to modern building standards." He added, "When Paradise gets rebuilt, it's going to have different standards. It's got to have that" (ibid.). This very spirit was shared and explicitly strengthened by Paradise's mayor, Jody Jones, who herself had left her home to the Camp Fire. She was quoted as saying, "They didn't abandon New Orleans after Katrina, they are not abandoning Hawaii although there's a volcano going off, they're not abandoning San Francisco despite the earthquake dangers. … Anywhere you go, there's some risk of a natural disaster. We are not going to abandon our town" (ibid.).

It is here where a gray zone between pragmatism and denialism emerges. Certainly, the mayor had every reason to sustain and to encourage confidence when addressing the local community and the wider public via the media. By the same token, however, her utterances were authentic in a different sense as well: the very question of public accountability remained one more time unaddressed. After all, both the county and the municipal administration were responsible for the decision to dismiss the Butte County Grand Jury recommendation of 2009 to establish a moratorium for new housing in fire-prone areas (GJ, 2009, R 6). Available post-Camp Fire imagery makes evident what was at stake (see the cover picture of this book).

If this is already a striking example of what Lawson and Smith (2023) call the Amenity Trap—the desire of middle-class people to live in a beautiful landscape at the Wildland Urban Interface (WUI)—an even more specific example is the dismissal of the recommendations of the Grand Jury after the Humboldt Fire of 2008 concerning potential escape routes. The Jury's report aptly contrasted the "desirable features" of the towns of Paradise in the Upper Ridge, on the one hand (clean air, secluded forest

setting, above the fog line, nice views, light snow in the winter), with "less desirable safety related features," on the other hand (limited water supply—including emergency water supply, high population density, vast amounts of fire fuel on steep terrain, earthquake and flood concerns related to Magalia Dam, limited number of emergency evacuation routes) (GJ, 2009, pp. 46–47). The report stated explicitly: "Major problems discovered as a result of the 2008 fires were limited evacuation routes and lack of compliance by the public concerning fire prevention regulation" (GJ, 2009, p. 46). The report thus contained a detailed analysis of the existence and conditions of potential escape routes in Butte County in case of wildfires. That included a categorisation of the relevant roads according to length in terms of mileage, number of lanes, type of paving, existence or nonexistence of shoulders, type of curves, existing speed limit, and level of fire hazard. The result was a classification of the respective "Evacuation Route Potential." According to the Jury's estimate, the "Skyway" from Paradise to the town of Chico as well as Clark Road connecting the Skyway to Pentz Road had the highest potential as future escape routes (GJ, 2009, p. 49).

In the fall of 2018, an extraordinarily long period of drought subsequent to a period of intensive rain had resulted in intensive growth of fuel in the forest surrounding Paradise which in turn had severely aggravated the risk of devastating wildfires. While substantial improvements had been achieved by then, including a multiagency training exercise involving first responders conducted in Paradise in 2016 and referred to repeatedly in the relevant NIST report (NIST, 2023, pp. xii, 39), crucial steps to strengthen risk mitigation recommended in the Grand Jury report of 2009 were omitted. As a team of *Los Angeles Times* journalists found out soon after the Camp Fire, to some extent the municipality of Paradise had done the opposite of what the Grand Jury had deemed to be indispensable. In 2015, "the city [of Paradise] decided to narrow a portion of the main road through town from four lanes to two as part of an effort in the downtown area aimed at boosting commerce as well as traffic and pedestrian safety" ("Paradise narrowed its main road by two lanes despite warnings of gridlock during a major wildfire," by Paige St. John, Rong-Gong Lin II, and Joseph Serna, *Los Angeles Times*, November 20, 2018a). The *LA Times* article continued with an indicative description of the underlying rationale: "Two other roads in the city were also narrowed, records show. The so-called Skyway 'road diet' slowed traffic, and a local civic group donated benches and landscaping to beautify the zone" (ibid.).

Yet, the journalists conceded, "It's far from clear whether the narrowing of Skyway … worsened the chaotic delays in getting out," referring to a statement by Mayor Jody Jones. According to the mayor, the evacuation of Paradise began at 7:46 a.m. on November 8, 2018, and was completed by 3:00 p.m. (ibid.). Again on a fatalist note, she added, "I don't believe that it really mattered. (…) I don't think there's any town in the world prepared with a roadway infrastructure that could evacuate their entire town all at once. They're just not built to do that" (ibid.).

What is clear indeed, however, is that the Town of Paradise had had financial incentives and community-related counterincentives to disregard the Grand Jury's recommendation to widen escape routes such as the Skyway. Paradise had mobilised funds from the California Department of Transportation for the above-mentioned "road diets." Those funds were designed to reduce travel lanes on inner city roads and to add bicycle lanes. Related measures were taken on the Skyway, on Clark Road and on Pearson Road, the latter according to the *Los Angeles Times* "a major cross street that became jammed during the fire evacuation" (ibid.). Funding by the state of California contributed to a whole package of improving road and traffic-related infrastructure such as raised rumble strips, better drainage, wider shoulders, and upgrade traffic signals (ibid.). From a mere municipal development perspective, narrowing instead of widening the potential escape route of Skyway was, according to all evidence, a more than plausible strategy. It just did justice to legitimate desires and concerns from both average residents and the business community. The design of the Skyway had been criticised as an "expressway" with no incentives to stop for shopping purposes but, instead, "imperiling any who tried to walk across" (ibid.). So the status quo ante was characterised by traffic engineers, according to *Los Angeles Times* reporting, as a situation that "limited the town's ability to realize its potential as a center of commercial and cultural activity" (ibid.).

Further investigations by the same team of *Los Angeles Times* journalists revealed serious errors committed by the municipality of Paradise itself and the City Fire Chief ("Here's how Paradise ignored warnings and became a deathtrap," by Paige St. John, Joseph Serna, Rong-Gong Lin II, *Los Angeles Times*, December 30, 2018b). The Chief and his predecessor (who was Paradise's emergency management director during the Camp Fire) confirmed that the evacuation plans had never anticipated the need to evacuate Paradise's entire population all at once. Emergency drills such as the one of 2016 were performed and were built around the experience

with slower-moving wildfires that had happened in the past (ibid.). Accordingly, those drills, especially when performed successfully, rather created the illusion of preparedness than signaling what needed to be planned under worst-case scenario conditions. However, it seems that not everyone shared these same illusions. The *LA Times* team of journalists interviewed a former city official of Loomis (CA) where he had already lost a home to fire before moving to Paradise in April 2018 where he again lost his house on November 8 the very same year. This resident did not conceal being flabbergasted by what he perceived as unacceptable indolence of the municipal leadership. He explicitly referred to the mayor's statement that, allegedly, building escape routes for evacuating the city of Paradise entirely at once would be impossible and, especially, to the fact that this very assessment, if real and not just a superficial excuse, had not been communicated to the residents (ibid.).

Moreover, the very phenomena that triggered the devastating firestorm which almost wiped out Paradise as a habitat could have been anticipated, according to experts. What caused the firestorm and the speed with which it spread was flying ember. Flying ember travels great distances in a very short time and the fire spreads much faster than through the accelerated spread of the flames themselves. The phenomenon was known in California at least since the firestorm in the Oakland Berkeley Hills in 1991. This, as the *LA Times* journalists found out, had been explicitly articulated in the State Fire Management Plan for the Ridge region, "developed in consultation with … Paradise planners" (ibid.). In this document, an "east wind" fire of "the same type of fire that impacted the Oakland Berkeley Hills during the October 20, 1991, firestorm" was explicitly mentioned as the "greatest risk" for Paradise (ibid.).

4.5 Political Horse Trading at the Expense of Fire Protection

The state of California has its own share of responsibility when it comes to government inaction and ambiguity in the fight against wildfire hazards. Unlike many other regions in the world heavily affected by increased risk of natural disasters due to climate change, California takes pride not only in one of the most advanced environment protection regulatory regimes but also in the credible commitment to mitigating the risk of wildfire whose institutional backbone is the California Department of Forestry

and Fire Protection or, briefly, Cal Fire. After all, California has a tragic history of disastrous fires destroying tens of thousands of homes and claiming human lives that, in principle, could have been saved if appropriate preventive measures would have been taken in due time.

One of those measures was the fire prevention fee introduced in 2011. It had to be paid by approximately 800,000 property owners living in State Responsibility Areas (SRAs) (California Department of Tax and Fee Administration [CDTFA], https://www.cdtfa.ca.gov/taxes-and-fees/fire-prev-fee.htm; for SRAs see also NIST, 2021, pp. 12–13). The amount was $153 per year for one "habitable structure." The fee, moderate as it was, came under immediate attack from taxpayer associations supported by the Republican party. It was ultimately suspended in the course of a political bargain between Democrats and Republicans in the California state legislature in July 2017 ("State suspends fire fee in cap-and-trade deal," by Karen Brainard, *San Diego Union Tribune*, July 31, 2017). The agreement was that in exchange for the suspended fire prevention fee the California cap-and-trade programme promoting the reduction of carbon dioxide and other greenhouse emissions was to be extended for 13 more years. The programme sets a limit (cap) to carbon dioxide emissions while simultaneously establishing the option for companies to trade greenhouse emissions for which they are responsible for a variable price to be paid for the maintenance or expansion of carbon dioxide consuming natural resources such as forests. Cap-and-trade programmes are in use in many places in the world, particularly in the European Union where a similar programme was launched in 2005 (EU Emissions Trading System EU ETS) and proclaimed one of the most progressive measures against global warming.

The "deal" that resulted in the suspension of the fire prevention fee by the California legislature was, however, structurally inconsistent and politically fragile from the very outset. The inconsistency came with the nature of the underlying political mechanism as such, known as logrolling (Wilson, 1969; Schwartz, 1977) or, in more banal terms, political horse trading. Logrolling—the metaphor referring to logs being rolled uphill by two groups of workers who would not be able to do the job alone, but who can exchange their alternate support—implies the prevalence of reaching an agreement at all over the substance of the agreement. The mechanism has therefore been characterised by some political scientists and economists as a virtue of democracy (Lindblom, 1959, 1965; Buchanan & Tullock, 1962) since it may help to overcome political

stalemate and inertia. The flipside is, however, that the actual quality and purpose of public policy along with effective and precisely focused policy instruments may be sacrificed for the sake of reaching a compromise at all.

Which is exactly what characterised the "deal" in the California legislature of July 2017. The fire prevention fee was an instrument designed to improve and expand specified fire protection measures such as brush clearance, property inspections, mapping of fire danger areas, and emergency evacuation planning. The cap-and-trade programme, by contrast, incentivises the maintenance and expansion of carbon dioxide consuming biospheres without further specification or focus. So, in reality, abandoning a specified and focused policy instrument designed to improve fire protection in exchange for expanding a general programme designed to reduce greenhouse emissions meant primarily to increase the risk of wildfire hazards threatening human lives.

Moreover, the mechanism of the deal, especially the part concerning the expansion of the cap-and-trade programme, turned into a self-destructive prophecy. Wildfires destroy the carbon dioxide reducing biospheres which, in turn, impacts on the attractiveness of the programme as such. Major corporations such as Microsoft or Green Diamond Resource had to realise that the Camp Fire of November 2018 destroyed many forested areas in whose preservation they had invested funds in the framework of the cap-and-trade programme ("Wildfires rage and a tool to combat climate change goes up in smoke. Forest-based carbon credits used to offset carbon emissions are burning," by Debra Kahn, *Politico*, July 27, 2021). So, basically, the "deal" of July 2017 was the proverbial rotten compromise (Margalit, 2009) that had undermined its own alleged purpose. The suspension of the fire prevention fee implied increasing wildfire risks while the attractiveness of investment in greenhouse emissions reducing biospheres decreased.

What made the policy inconsistency of the "deal" in the California legislature even more consequential was the fact that the funds raised through the fire prevention fee where allegedly ineffectively used while the *Los Angeles Times* reported that "some $200 million was taken from the Department of Forestry and Fire Protection for the general fund with the money replaced by the fee" ("Some GOP lawmakers hail suspension of fire prevention fee as victory, but others see a bait and switch," by Patrick McGreevy, *Los Angeles Times*, July 23, 2017). This fueled criticism of the fee in general and created a political climate in which its suspension became popular among homeowners especially, and necessarily so, in rural areas representing the main constituencies of the Republican party in the state

of California otherwise politically dominated by the Democrats. As a consequence, two archetypical components of conservative discourses converged, one addressing the alleged tax-and-spend mentality of liberal politicians, the other one addressing the alleged inefficiency and ineffectiveness of "big government."

The political fragility of the "deal" whose immediate effect was the suspension of the fire prevention fee came to the fore when heavy disputes broke out within the Republican party after a minor group of Republican representatives California state legislature had made the deal possible in an agreement with the Democrats ("Some GOP lawmakers hail suspension …," *Los Angeles Times*, July 23, 2017). The critics referred to the extension of the cap-and-trade programme as a measure implicitly reducing refined oil supply, thus allegedly leading to increasing prices at the gas station by $0.24–$0.73 per gallon. According to those critics, the deal made possible by the leadership of the Republican party in the California state legislature would allegedly "cost the average California motorist and additional $400 for gas each year" (ibid.). After the "deal" and the extension of the cap-and-trade programme with the help of Republican state assembly members, conflicts within the Republican party became fierce ("Eight Republicans backed Jerry Brown's climate change bill—here's what that means for their political futures," by Melanie Mason, *Los Angeles Times*, July 19, 2017). Republican minority leader in the California state legislature, Chad Mayes, was forced to step down in August 2017. Together with former governor and actor Arnold Schwarzenegger and then Ohio Governor John Kasich, Mayes formed "New Way California," a group of moderate Republicans, and eventually left the Republican Party in December 2019.

The fallout of the "deal" reached in the California state legislature was not limited to the Republican party, however. Criticism from the Democratic party's left wing was countered by Democratic governor Jerry Brown with reference to the necessity to secure "affordable housing" (Los Angeles Times, July 19, 2017). This was a clear sign how seriously the leadership of the Democratic party took the political pressure mobilised by the alliance of tax payers' associations and the California Republican Party against the fire prevention fee.

So, in sum, what the fate of the fire prevention fee demonstrates is the potentially counterproductive interaction of policy discourse and ill-fated policy instruments. Regardless of the actual accuracy and effectiveness of the fee itself, its introduction in 2011 pointed to the right direction. If it

would have been linked to supportive political communication by its proponents, the moderate additional financial burden for homeowners amounting to $153 per year could have strengthened risk mitigation—especially brush clearance and emergency evacuation planning—and related public awareness at the same time. The fact that the suspension of the fire prevention fee in 2017 was politically affordable even for the Democratic party is indicative in more than one sense. It demonstrates that very much depends on an appropriate understanding of the intricacies of policy instruments among political elites, on the one hand, and a carefully calibrated communication strategy, on the other. The fact that focused measures of fire protection financed through earmarked public funds reduces threats to life and limb of residents in fire-prone areas is a message easy to communicate. Similarly, showcase examples of protection and prevention ("Your fire prevention fee dollars at work") could have been launched as well. Suspending the fee, however, meant to surrender to the consequences of one's own inaction instead.

4.6 Multi-causality and Risk Mitigation

The causal factors and mechanisms culminating in the Camp Fire itself and its disastrous consequences especially for the city of Paradise were technical, organisational, and political in nature. Some of these mechanisms had developed over a long period of time, shaping the perceptions and incentives of the actors involved, while others only came into play on the day of the disaster.

The ignition of the wildfire that became one of the deadliest disasters in Californian history was a predictable failure of infrastructure. When a critical component of a high-voltage power line of Pacific Gas and Electric Company (PG&E), a so-called C hook, broke and malted metal fell on the parched grass and brush beneath the pole to which the hook was attached, the ignited fire spread with extreme velocity due to strong winds from the East, well known in the region as Jarbo winds. Strong winds with gusts between 41 mph and 52 mph were frequent in the so-called Jarbo Gap, occurring approximately 20 times per year, primarily from October through February (CFPR, p. 69). These winds can cause embers to fly long distances and start a firestorm. The phenomenon itself was known and documented in the State Fire Management Plan of California, referring to the fire storm in the Oakland Berkeley Hills in 1991, and specifically to similar risks for the town of Paradise. What was also known through

the diligent assessment of the origins and consequences of the Humboldt Fire of June 2008 by a Butte County Grand Jury was that the town of Paradise was not only located in a fire-prone area but also exposed to aggravated risks connected to housing development and an insufficient number and condition of escape routes in case of wildfire. At least, a fire prevention fee existed in California since 2011, amounting to $153 per year and "inhabitable structure."

There were a series of conditions and causal mechanisms that, despite high levels of public awareness, incentivised inaction and omissions regarding risk mitigation. One was neglected coordination in the horizontal and vertical dimension. This pertained to the coordination between infrastructure maintenance as a shared task of PG&E, the California Department of Forestry and Fire Protection (Cal Fire), and the California Public Utilities Commission (CPUC). To what extent CPUC had assumed its original task as a regulatory agency vis-à-vis PG&E remained unaddressed in the Butte County Grand Jury report of 2020. The Butte County Board of Supervisors rejected as "not reasonable" the recommendation of a home building moratorium made by a Butte County Grand Jury after the Humboldt Fire of 2008 ("Rebuild Paradise? Since 1999, 13 large wildfires burned in the footprint of the Camp Fire. The town's topography, climate and history leaves it vulnerable," *Mercury News*, December 2, 2018). A traffic artery in the town of Paradise, the "Skyway," was not reshaped as the main escape route in case of wildfires but narrowed and "beautified" in order to make it more attractive as a center of business and community life ("Paradise narrowed its main road by two lanes despite warnings of gridlock during a major wildfire," *Los Angeles Times*, November 20, 2018). At the state level, the fire prevention fee introduced in 2011 was suspended by the California legislature in July 2017 in a "deal" between Democrats and Republicans in exchange for the extension of the greenhouse gas emissions regulation, known as cap-and-trade programme until 2030 ("Eight Republicans backed Jerry Brown's climate change bill—here's what that means for their political futures," by Melanie Mason, *Los Angeles Times*, July 19, 2017).

While these phenomena of policy inaction and counterproductive measures can be attributed to what Lawson and Smith (2023) have termed the "amenity trap," the actual incentive structure that made reasonable actors taking an unreasonable course of action can be specified in more detail. In a local community like Paradise, a town founded only in 1979 with some 26,000 inhabitants in 2018, the amenity trap was typical for a settlement

at the Wildland Urban Interface (WUI) with a preference for affordable middle-class housing in an attractive land landscape with sufficient and reliable infrastructure but known and accepted risks of natural hazards. The acceptance of natural hazard risks, however, was not based on mere ignorance and indolence. There was a clear awareness of the increased risk of wildfires among professional responders (cf. the detailed account by Maranghides et al. in NIST, 2023). Without this awareness and the resulting fire and evacuation drills, the death toll from the Camp Fire would undoubtedly have been even much higher than the 86 fatalities of November 8, 2018.

So, just like Katherine Blunt in her book *California Burning* (2022) emphasised, the actual causal mechanisms that turned a wildfire into a devastating disaster were particularly complex. One contributing factor was the illusion of preparedness which resulted, quite ironically, from high levels of formal safety and preparedness standards. On the one hand, this pertained to PGE&E's inspection protocol whose merely symbolic use, according to Blunt (2022, pp. 122–141), remained unrecognised and unchecked by the California Public Utility Commission (CPUC). On the other hand, it pertained to the general awareness of wildfire risks and a high standard of firefighting and evacuation drills at the local level. The resulting complacency came to the fore still in the fatalist comments of officials after the Camp Fire that had destroyed more than 18,000 structures and had claimed the lives of 85 people. The underlying cognitive mechanism was, according to all likelihood, a misunderstanding of risk reduction in the first place. By definition, risk mitigation is based on a probabilistic rather than deterministic logic. Precisely because the exact nature of complex causal chains cannot be determined in advance, known risks have to be eliminated under any circumstances as soon as the protection of human life and limb is at stake.

To some extent, the omission of feasible and generally accepted hazard risk mitigation measures may be explained by what Kahneman and Tversky (1979, 1981) have characterised as *loss aversion*: human actors put more emphasis on perceived losses than on uncertain gains. This applies to any kind of risk reduction since related restrictions imply tangible losses while the gain in security usually remains intangible. Resisting the incentives to forego necessary protective measures for the alleged benefit of citizens and taking appropriate measures instead is a question of leadership and "active responsibility" (Bovens, 1998, pp. 143–230). In that sense, the suspended fire prevention fee, the unimplemented moratorium on development

projects in fire-prone areas, and the conversion of parts of the Skyway in Paradise into an amenity area for recreation and shopping instead of turning it into an effective escape route are indicative. Yet, these counterproductive steps were taken with the consent of the local community whose physical protection was at stake.

So, the cohesion of a relatively homogeneous middle-class community is both an asset and a liability when it comes to natural hazard risk mitigation. Since affordable housing in a preferred habitat is usually in considerable demand, imposing a moratorium on new homes in fire-prone areas was dismissed as "not reasonable" by the Butte County Board of Supervisors. Likewise, one of the potential evacuation routes in the town of paradise, the Skyway, was not widened and streamlined as suggested by the Butte County Grand Jury in its 2009 report on the Humboldt Fire. Instead, the Skyway was modernised with the assistance of the California Department of Transportation's "road diets" programme in the attempt to eliminate the "expressway" character of the Skyway through reducing its four lanes to two and to make it more attractive as a shopping area. The quest for affordable housing and political pressure from taxpayer associations and the California Republican Party, in turn, paved the way for a political bargain in the state legislature in 2017 in which Democrats and a group of Republicans agreed to scrap the existing fire prevention fee. In exchange, the environment protection programme known as "cap and trade" was extended until 2030. The programme provides for a limit (cap) of carbon dioxide and other greenhouse emissions through allowances accorded to emitters that can be traded on a market so that stronger demand for allowances leads to higher prices which in turn creates incentives to reduce emissions in the first place and to invest in the maintenance and extension of carbon dioxide absorbing biospheres.

Although the reports of the US National Institute of Standards and Technology on the Camp Fire (NIST, 2021, 2023) refrained from critical assessments of relevant political action, they nonetheless reflected the very ambivalence of social cohesion in local communities when it comes to natural hazard risk mitigation. Report No. 4 on Notification, Evacuation, Traffic, and Temporary Refuge Areas (NIST, 2023) indirectly addressed, in frightening detail, the linkage between an insufficient width of evacuation routes, traffic jams, and blocked "egress arteries": "Two or more of the four egress arteries leaving Paradise were simultaneously closed due to fire for 68% of the time between 08:00 and 14:45" (NIST, 2023, p. 228, referring to the actual time span of evacuation). It was specified that "fire

impacted some egress arteries directly (through fire exposure and reduced visibility due to smoke) and others indirectly through downed utility poles and lines and downed/burned trees" (ibid.) which caused 230 vehicles abandoned on the major egress arteries of which 60% were burned. Insufficient width of escape routes intensified the impact of burnovers defined as "an event in which a fire moves through a location or overtakes personnel or equipment where there is no opportunity to utilise escape routes and safety zones, often resulting in personal injury or equipment damage" (NIST, 2021, p. 116, quote from National Wildfire Coordinating Group [NWCG]). NIST Camp Fire Report No. 1 stated: "Burnovers resulted in civilian fatalities, civilian and first responder injuries, and destruction and damage of civilian and first responder vehicles" (NIST, 2021, p. 116). This, according to the report, happened in Paradise on "Pearson Road and on Skyway, where gridlocked traffic resulted in fatalities, injuries, and/or damage to vehicles" (ibid.).

The NIST reports thus implicitly confirmed that the width and the existence or nonexistence of multiple lane escape routes were crucial. The report explicitly quoted NWCG's statement about the linkage between "compromised escape routes" and life-threatening entrapment since burnovers result in "a situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes or safety zones are absent, inadequate, or compromised" (NWCG, 2020, quoted in NIST, 2021, p. 166). Escape routes in Paradise were "compromised" indeed through the omission to fully implement relevant recommendations of the 2009 Butte County Grand Jury due to considerations of community amenities. Indicative enough, Paradise residents had made donations for benches to be placed on pavements usable as improvised escape routes in case of evacuation (Los Angeles Times, November 20, 2018).

At the same time, however, the NIST Report No. 4 in its entirety gave an impressive account on civic involvement in notification, first response, establishing and securing temporary refuge areas and shelters and rescue operations. Without a solid foundation in a cohesive local community, it is hard to imagine that kind of strong commitment and effective cooperation between volunteers, firefighters, and the police. Which is in turn in accordance with the more optimistic assumptions in the relevant literature about the relationship between social cohesion, resilience, and recovery (cf. Aldrich, 2012; Hackerott, 2022; Jerolleman, 2022; Prior & Eriksen, 2013; see also Sect. 4.8 of this chapter).

4.7 Learning and Prevention

Complex as the causality leading to the Camp Fire and its catastrophic consequences was, the actual configuration of causal factors is accessible for a more systematic analysis for the sake of generalization and learning. Some causal factors such as the merely symbolic implementation of PG&E's inspection policy and an elevated level of risk acceptance can be classified as permissive conditions. They made risk-increasing decisions or omissions such as poor maintenance of critical infrastructure or new housing projects in fire-prone areas more likely to occur but not unavoidable. Similarly, risk-increasing decisions or omissions themselves did not make the final disaster per se inescapable. Which in turn implies two critical zones of intervention: one at the interface between permissive conditions and actual and avoidable decisions or omissions and one at the threshold at which risk-increasing decisions or omissions become truly consequential. Conversely, actual catastrophes can be averted if permissive conditions are neutralised at the permissive conditions./. actual agency interface and the consequences of risk-increasing decisions or omissions are stopped or at least contained at the near miss./. actual occurrence threshold.

Relevant charactersiations of causality have been outlined in the literature according to Coleman's (1990) model based on methodological individualism (cf. Elster, 1989; Hedström & Swedberg, 1998; Hedström & Ylikoski, 2010) and referring to three types of mechanisms—situational, action formation, and transformational. According to this classification, action formation mechanisms are the actual drivers of human behavior but they are embedded in situational mechanisms in the sense of permissive conditions. Transformational mechanisms, in turn, are the productive force through which action formation mechanisms result in final outcomes of causal processes (Fig. 4.1).

Applied to the Camp Fire, its prehistory, and its effects, the model of Hedström and Ylikoski (2010) allows for a more detailed analysis on the basis of classic definitions of individual mechanisms. As the report of the Butte County Grand Jury of 2020 revealed, PG&E's safety rules and guidelines were precise and clear. They were just not implemented. Rather than shaping the actual practice of inspections and maintenance services, safety and inspection guidelines served just a symbolic purpose securing formal compliance with regulatory requirements. The practice of paying mere lip service to rules and regulations in order to cover up noncompliance is known in the literature as "mock bureaucracy" (Gouldner,

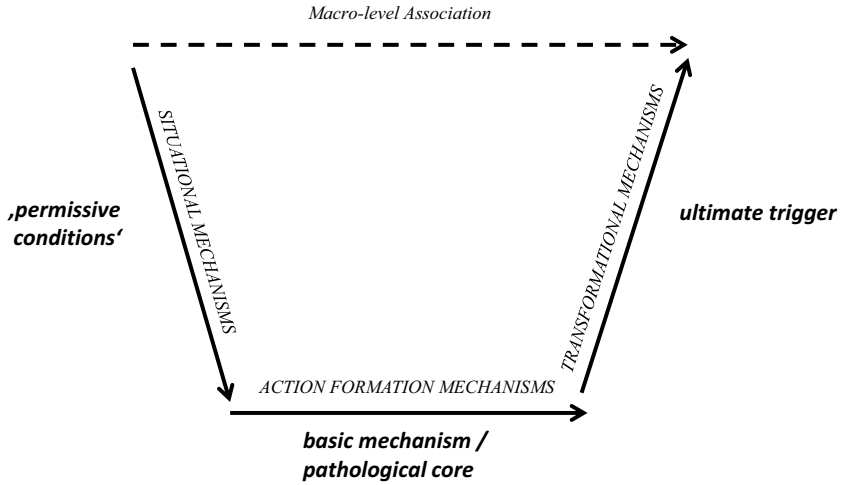

Fig. 4.1 A configurational model of causal mechanisms

1956) or "symbolic use of politics," respectively (Edelman, 1964). It did not just apply to PG&E but apparently, according to Blunt (2022, pp. 133–141), also to the California Public Utility Commission (CPUC) as the relevant regulatory agency. Knowingly or unknowingly, the CPUC presumably tolerated the actual non-compliance of PG&E. As Katherine Blunt put it: "The CPUC, with its small staff and much larger policy team, was blind to an overwhelming problem snowballing within PG&E" (ibid., p. 135). Which can be characterised as an information asymmetry and principal-agent problem (Akerlof, 1970; Grossman & Hart, 1983). The result was not only CPUC's inaction but also the absence of coordination between PG&E and the California Department of Forestry and Fire Protection (Cal Fire). Their relationship fell into the category of what had been termed by James D. Thompson in his classic study on *Organizations in Action* (1967) as reciprocal interdependence: The continuous interaction of separate organisational units being indispensable for coherent and effective action. What these factors have in common is their nature as *situational mechanisms* in the sense of permissive conditions.

What aggravated those conditions and made fatal omissions even more likely to occur was a high level of risk acceptance in local communities. Risk acceptance is not shaped by evidence alone but also by plausibility

and latent social pressure (cf. Douglas, 1986, for a detailed account). Just like PG&E's and CPUC's main safety concern was the stability of electricity service procurement rather than the tedious and costly inspection and maintenance of transmission lines exposed to the risk of fire ignition in remote areas, risk acceptance at the community level was exposed to counterincentives in the form of amenable and affordable living conditions. Insisting on effective fire prevention and protection implies higher costs of development projects and construction of homes, potentially exceeding the financial means of middle-class homeowners. At the same time, middle-class communities are articulate actors able to exert latent or manifest pressure on public policymakers and relevant authorities.

The situational mechanisms described so far made risk-increasing action and omissions of relevant actors more probable—without making them inevitable, however. What characterised the *action formation mechanisms* "on the ground"—the state and the municipal level—was a double logic of loss aversion and logrolling (Kahneman & Tversky, 1979, 1981, and Wilson, 1969, or Schwartz, 1977, respectively). Local agencies and their representatives were apparently unwilling to impose restrictions on risk-increasing housing and urban development plans for the sake of improving fire protection. Instead, they, according to all likelihood, wanted to do justice to what they perceived as legitimate expectations of the local communities and constituencies. Members of the state legislature of California, in turn, sacrificed the existing fire prevention fee in exchange for the extension of the cap-and-trade programme, the cap stone of California's ambitious environment protection policy.

Finally, when it comes to what Hedström and Ylikoski (2010) termed *transformational mechanisms* the picture is mixed. While the decisive measure to de-energise the Caribou-Palermo power line on November 8, 2018, was omitted, the determined and effective response and rescue operations of firefighters, police, and volunteers saved many human lives despite disastrous conditions (cf. Butte County Office of Emergency Management Camp Fire Response County-Wide After Action Report, 2020, pp. 26–31; NIST, 2023). It was exemplary resolve and initiative-taking leadership (Bruttel & Fischbacher, 2013) as a mitigating mechanism. The fact that the Caribou-Palermo power line was not de-energised despite early warning signs and extremely strong Jarbo winds was, on the one hand, the effect of PG&E mismanagement. The bitter irony was that PG&E had indeed swiftly performed a public safety power shut-off in October 2018 due to strong winds and the risk of sparks in bushfire-prone

areas. That step came as an unpleasant surprise for 97,000 and 60,000 homes and facilities like restaurants and grocery stores that went off the grid on two subsequent days (Blunt, 2022, pp. 195–196). Related complaints probably made decision-makers in the PG&E wildfire operations centre reluctant to take the same step when a similar situation occurred on November 8, 2018—a case of pathological experiential learning (March & Olsen, 1975) and as such an aggravating mechanism. On the other hand, however, the California Public Utilities Commission (CPUC), in accordance with its own Public Safety Power Shut-Off guidelines (PSPS), should have been aware of the fact that the Caribou-Palermo power line due to its relatively low voltage status (115 kV) was exempted from the particular PSPS notice that allowed, according to the Butte County Grand Jury's 2020 Camp Fire Public Report, "to proactively de-energize at-risk power lines during wind events" (CFPR, p. 72). The combined ignorance and inaction of PG&E as a private corporation and CPUC as the responsible public authority converted what could have remained a near miss situation into the ignition of a disastrous wildfire (Table 4.1).

So it was basically and decisively about two missed opportunities at two different zones of potential intervention. As outlined above, one possible but omitted intervention should have targeted the interface between

Table 4.1 Differentiated causal mechanisms contributing to the camp fire catastrophe

Type of mechanism	*Mechanisms contributing to the camp fire catastrophe & Classic theoretical references*
Situational mechanisms/ permissive conditions	Corporate governance and regulatory control as "mock bureaucracy" (Gouldner, 1956) Symbolic use of politics (Edelman, 1964) Information asymmetry and principal agent problems (Akerlof, 1970; Grossman & Hart, 1983) Absence of coordination despite reciprocal interdependence (Thompson, 1967) High level of risk acceptance in local communities (Douglas, 1986)
Action formation mechanisms	Loss aversion (Kahneman & Tversky, 1979, 1981) Logrolling (Wilson, 1969; Schwartz, 1977)
Transformational mechanisms	Pathological experiential learning (March & Olsen, 1975): no shut-down of Caribou-Palermo line on November 8, 2018 [aggravating] Initiative-taking leadership (Bruttel & Fischbacher, 2013): swift and resolute response by fire fighters and policy on November 8, 2018 [mitigating]

situational mechanisms or/and action formation mechanism. PG&E's use of safety standards and inspection rules primarily as a tool of formal legitimisation was tolerated by the California Public Utility Commission (CPUC) instead of neutralising its interaction with the counterproductive action formation mechanisms that shaped the decisions and omissions of local and state-level public officials. The main action formation mechanisms were "loss aversion"—avoiding what citizens could perceive as unnecessary restrictions—and political horse trading (logrolling) to which the California fire prevention fee fell prey.

This meant prioritising short-term liveability improvement and "affordable housing" at the expense of sustainable preparedness for, and protection against, wildfires. If state and municipal government would have taken seriously what, in this respect, the Butte County Grand Jury had recommended in 2009 they would have acknowledged and neutralised the risk-increasing effects of housing developments in fire-prone areas and narrow escape routes while the state legislature of California would have upheld the moderate fire protection fee of $153 per year and "habitable structure", that is, household. The decisive intervention, however, should have been designed to neutralise the transformational mechanisms on the very final stretch of the disastrous causal chain. This is what desperate but heroic emergency and rescue teams did on November 8, 2018, but what PG&E and CPUC did not initiate when the Caribou-Palermo power line was not de-energised in due time despite existing guidelines that provided for just such measures in case of "wind events (Fig. 4.2)."

In terms of generalisation, risk awareness as such remains futile as long as it just consists of abstract mindfulness. Mindfulness when it comes to natural hazards needs to be connected to knowledge-based identification of actual risk zones not just in nature itself but in political life and administrative reality as well. This entails realistic acknowledgment of standard pathologies of organisational behavior and politics. In principle, these pathologies are easy to recognise and therefore easy to keep under control. A merely symbolic use of safety and inspection standards resulting from budget constraints as well as silo mentality, turf logic, and related coordination issues in complex organisations are phenomena seasoned practitioners are familiar with. Those deficiencies need to be recognised and neutralised when threats to human life and limb are at stake. The same holds for the temptation of loss aversion and logrolling in politics and actual policymaking. However, neither the Camp Fire Public Report of June 2020 composed by a Butte County Grand Jury nor the reports of the

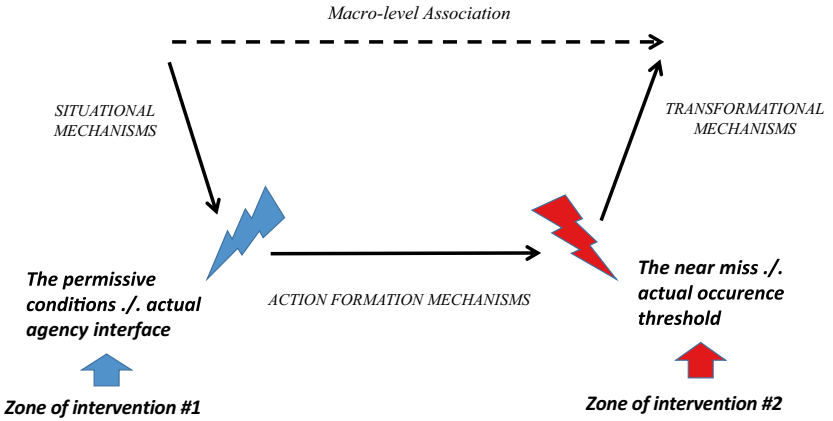

Fig. 4.2 Configuration of causal mechanisms and zones of intervention

US National Institute of Standards and Technology did explicitly address public accountability issues. The prospects of strategic learning for the sake of sustainable prevention are therefore limited.

4.8 Postscript: Tactical Learning, Improvisation, and New Alliances

Of the 26,000 people living in the town of Paradise prior to the Camp Fire of November 2018, approximately 5,000 residents were left in 2020. In 2024, the figure had risen to some 10,600 residents, yet less than half the size of the community before November 2018. It is bitterly ironic and encouraging at the same time that the extreme character of a wildfire that destroyed almost an entire community also made the town of Paradise a paragon of post-disaster recovery. While the declared determination of Mayor Jody Jones immediately after the catastrophe never to "abandon" Paradise might have appeared as the proverbial courage of desperation, the municipality of Paradise made indeed every effort to implement sustainable risk mitigation strategies at the best of the community's ability. Tragic and consequential as it was, the Camp Fire had removed major obstacles to sustainable risk mitigation in terms of mindsets and countervailing stakeholder interest.

The Paradise Transportation Master Plan of May 2022 (Town of Paradise, 2022) and the 2024/2025 Recovery Action Plan (Town of Paradise, 2024) are the relevant post-disaster documents for housing, infrastructure recovery, and adapted road design. An essential part of the transportation masterplan is a concept to streamline the networks of inner-town streets as potential escape routes. The Masterplan integrates not only major arteries of traffic but also smaller and inevitably narrow streets in a comprehensive system of risk mitigation in anticipation of necessary evacuation. The plan is designed to remove "chokepoints" and previously preserved pedestrian crosswalk refuge centre islands in the middle of major roads "identified as a constraint during the Camp Fire evacuation, preventing drivers from using the full pavement width" (Town of Paradise, 2022, p. 19).

A particularly intriguing and innovative component of risk mitigation, however, is the public-private partnership of the town of Paradise and private partners thus forging productive stakeholder alliances. Which holds particularly for the insurance industry. The insurance problem is more than dramatic when it comes to human habitats in the Wildland Urban Interface (WUI) in the wake of climate change (see Chap. 2). In natural hazard risk zones, insurance premiums become increasingly unaffordable for homeowners while insurances may not even offer contracts in the first place. To cope with the situation, the town of Paradise applied a dual-pronged strategy. One more traditional approach is to support homeowners to benefit from the California Fair Plan Property Insurance (cf. https://www.insurance.ca.gov/01-consumers/200-wrr/California-FAIR-Plan.cfm). It is meant to be a "last resort plan" in the form of premium subsidies for homeowners who otherwise could not afford insurance and therefore stood no chance to get a mortgage for financing their homes. Another, innovative approach is self-imposed regulation in the form of safety codes and certification criteria for structures and spatial planning. For this particular purpose, Paradise's municipal administration cooperates with the Insurance Institute for Business and Home Safety (IBHS) located in Chester County, South Carolina (cf. https://ibhs.org/about-ibhs/).

In the absence of an already agreed-upon but still not implemented system of state-wide fire protection regulation ("California is years behind in implementing a law to make homes more fire resistant," Capradio, January 17, 2025, by Nguyễn, T., The Associated Press), "self imposed" means to define and to implement safety standards and building codes in cooperation with the IBHS (cf. IBHS, NFPA and Verisk Analytics, 2023). Triggered by the traumatising shock of the Camp Fire and its devastating effects due, to a large extent, to combustible building material and insufficient or just inexistent fuel breaks, the cooperation between a governmental body and a private institution bridges the gap between inexistent state-wide regulation and the necessity of effective wildfire risk mitigation. New homes built in Paradise have to be constructed in accordance with municipal codes for fuel breaks and the reduction of structure ignitability (Town of Paradise, 2024, p. 5). Paradise's approach to make infrastructure more resilient and structures less ignitable is being complemented by a likewise self-imposed certification and inspection process. Inspections take place once a year and apply primarily to structure ignitability and fuel breaks (ibid.).

In the context of the US administrative state, mitigating risk in a Very High Fire Hazard Severity Zone (VHFHSZ) involves navigating a fragmented jurisdictional landscape. Which is anything but atypical. At the federal level, spatial planning is part of the jurisdiction of the US Department of the Interior's Bureau of Land Management. The Fire Service is part of the US Department of Agriculture while the Federal Emergency Management Agency (FEMA) belongs to the US Department of Homeland Security. The recovery strategy developed by the municipality of Paradise is designed to neutralise the undesirable effects of that fragmentation. It covers comprehensively risk mitigating land use planning, modernisation and maintenance of infrastructure, safeguarding potential escape routes, the reduction of fuel and enhanced fuel breaks, as well as the reduction of structure ignitability.

While it remains disturbing and encouraging at the same time that such comprehensive efforts only became possible under the trauma of the Camp Fire of November 2018, the very same logic applies to the support of local government by its constituency. Residents know what ultimately is at stake and their knowledge is generalisable. Which demonstrates how, in principle, amenity traps and safety illusions may be eliminated simultaneously.

References

Literature

Akerlof, G. A. (1970). The market for 'lemons': Quality uncertainty and the market mechanism. *Quarterly Journal of Economics, 84*, 488–500.

Aldrich, D. P. (2012). *Building resilience social Capital in Post-Disaster Recovery*. University of Chicago Press.

Blunt, K. (2022). *California burning. The fall of Pacific gas and electric—And what it means for America's power grid*. Portfolio/Penguin.

Bovens, M. (1998). *The quest for responsibility. Accountability and citizenship in complex Organisations*. Cambridge University Press.

Bruttel, L., & Fischbacher, U. (2013). Taking the initiative. What characterizes leaders? *European Economic Review, 64*, 147–168.

Buchanan, J. A., & Tullock, G. (1962). *The calculus of consent. Logical foundations of constitutional democracy*. University of Michigan Press.

Burby, R. J. (2006). Hurricane Katrina and the paradoxes of government disaster policy: Bringing about wise governmental decisions for hazardous areas. *The Annals of the Academy Political and Social Science, 604*(1), 171–191. https://doi.org/10.1177/0002716205284676

Catino, M. (2014). *Organizational myopia. Problems of rationality and foresight in organizations*. Cambridge University Press.

Coleman, J. S. (1990). *Foundations of social theory*. Harvard University Press.

Cutter, S. L., & Finch, C. (2008). Temporal and spatial changes in social vulnerability to natural hazards. *Proceedings of the National Academy of Sciences, 105*, 2301–2306. https://doi.org/10.1073/pnas.0710375105

Douglas, M. (1986). *Risk acceptability according to the social sciences*. Routledge and Kegan Paul.

Edelman, M. (1964). *The symbolic uses of politics*. University of Illinois Press.

Elster, J. (1989). *Nuts and bolts for the social sciences*. Cambridge University Press.

Eriksen, C., & Simon, G. (2017). The Affluence–Vulnerability Interface: Intersecting scales of risk, privilege and disaster. *Environment and Planning A: Economy and Space, 49*, 293–313. https://doi.org/10.1177/0308518X16669511

Gee, A., & Anguiano, D. (2020). *Fire in paradise: An American tragedy*. W. W. Norton & Co.

Gouldner, A. W. (1956). *Patterns of industrial bureaucracy. A case study of modern factory management*. The Free Press.

Grossman, S. J., & Hart, O. D. (1983). An analysis of the principal-agent problem. *Econometrica, 51*, 7–45.

Hackerott, C. S. (2022). Community resilience and crisis management. In A. Farazmand (Ed.), *Global encyclopedia of public administration, public policy, and governance*. Springer. https://doi.org/10.1007/978-3-030-66252-3_726

Hedström, P., & Swedberg, R. (Eds.). (1998). *Social mechanisms. An analytical approach to social theory*. Cambridge University Press.

Hedström, P., & Ylikoski, P. (2010). Causal mechanisms in the social sciences. *Annual Review of Sociology, 36*, 49–67.

Jerolleman, A. (2022). Community resettlement. In A. Farazmand (Ed.), *Global encyclopedia of public administration, public policy, and governance*. Springer. https://doi.org/10.1007/978-3-030-66252-3_2873

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision of the risk. *Econometrica, 47*, 263–291.

Kahneman, D., & Tversky, A. (1981). The framing of decisions and the psychology of choice. *Science, 211*, 453–458.

Lawson, M., & Smith, K. (2023). *The amenity trap. How high-amenity communities can avoid being loved to death*. Headwaters Economics.

Lindblom, C. E. (1959). The science of muddling-through. *Public Administration Review, 19*, 79–88. https://doi.org/10.2307/973677

Lindblom, C. E. (1965). *The intelligence of democracy. Decision making through mutual adjustment*. The Free Press.

Link, E., & Maranghides, A. (2024). *NIST camp fire case study - Research and outputs*. Slides prepared for the National Council for Science and Technology (NCST) Advisory Committee Meeting of March 6–7. Retrieved September 30, 2024, from https://www.nist.gov/system/files/documents/2024/03/05/02_LINK_NCSTAC_Mar2024_CAMP.pdf

Lukasiewicz, A., & Baldwin, C. (2020). *Natural hazards and disaster justice. Challenges for Australia and its neighbours. Palgrave MacMillan*.

Margalit, A. (2009). *On compromise and rotten compromises*. Princeton University Press.

Olson, R. S., Ganapati, N. E., Gawronski, V. T., Olson, R. A., Salna, E., & Sarmiento, J. P. (2020). From disaster risk reduction to policy studies: Bridging research communities. *Natural Hazards Review, 21*(2), 04020014–1–04020014-12. https://ascelibrary.org/doi/epdf/10.1061/%28ASCE%29NH.1527-6996.0000365

Prior, T., & Eriksen, C. (2013). Wildfire preparedness, community cohesion and social–ecological systems. *Global Environmental Change, 23*, 1575–1586.

Schwartz, T. (1977). Collection of issues and vote trading. *The American Political Science Review, 71*, 999–1010. https://doi.org/10.2307/1960103

Thompson, J. D. (1967). *Organizations in action. Social science bases of administrative theory*. McGraw-Hill.

Turco, M., Abatzoglou, J. T., Herrera, S., Zhuang, Y., Jerez, S., Lucas, D. D., Kouchak, A. A., & Cvijanovic, I. (2023). Anthropogenic climate change impacts exacerbate summer forest fires in California. *Proceedings of the National Academy of Sciences, 120*. https://doi.org/10.1073/pnas.2213815120

Wilson, R. (1969). An axiomatic model of logrolling. *American Economic Review, 59*, 331–341.

Media Sources

Brainard, K. (2017, July 31). State suspends fire fee in cap-and-trade deal. *San Diego Union Tribune*.

Gafni, M. (2018, December 2). Rebuild paradise? Since 1999, 13 large wildfires burned in the footprint of the Camp Fire. The town's topography, climate and history leaves it vulnerable. *Mercury News*.

Kahn, D. (2021, July 27). Wildfires rage and a tool to combat climate change goes up in smoke. Forest-based carbon credits used to offset carbon emissions are burning. *Politico*.

Mason, M. (2017, July 19). Eight Republicans backed Jerry Brown's climate change bill—here's what that means for their political futures. *Los Angeles Times*.

McGreevy, P. (2017, July 23). Some GOP lawmakers hail suspension of fire prevention fee as victory, but others see a bait and switch. *Los Angeles Times*.

Nguyễn, T. (2025, January 17). California is years behind in implementing a law to make homes more fire resistant. *Capradio*. The Associated Press.

St. John, P., Lin II, R.-G., & Serna, J. (2018a, November 20). Paradise narrowed its main road by two lanes despite warnings of gridlock during a major wildfire. *Los Angeles Times*.

St. John, P., Serna, J., & Lin II, R.-G. (2018b, December 30). Here's how Paradise ignored warnings and became a deathtrap. *Los Angeles Times*.

Public Documents

Butte County Grand Jury Report (2008/2009). Wildfire & safety considerations for butte county general plan 2030 [cited as GJ 2009, page number].

Butte County Grand Jury: Camp Fire Public Report (2020, June). [cited as CFPR, page number].

Butte County Office of Emergency Management Camp Fire Response County-Wide After Action Report (2020, August).

March, J. G., & Olsen, J. P. (1975). The uncertainty of the past: Organizational learning under ambiguity. *European Journal of Political Research, 3*, 147–171. https://doi.org/10.1111/j.1475-6765.1975.tb00521.x

NIST. (2021, January). National Institute of Standards and Technology. A case study of the camp fire—Fire progression timeline (NIST Technical Note 2135), by Maranghides, A., Link, E., Mell, W., Hawks, S., Wilson, M., Brewer, W., Brown, C., Vihnaneck, R., & Walton, W. https://doi.org/10.6028/NIST.TN.2135

NIST. (2023, July). National Institute of Standards and Technology. A case study of the camp fire—notification, evacuation, traffic, and temporary refuge areas (NETTRA) (NIST Technical Note 2252), by Maranghides, A., Link, E., Brown, C., Walton, W., Mell, W., & Hawks, S. https://doi.org/10.6028/NIST.TN.2252

NWCG. (2020). National Wildfire Coordinating Group: Entrapment. https://www.nwcg.gov/term/glossary/entrapment (quoted in NIST, 2021, no more accessible).

Town of Paradise. (2022, May). *Transportation master plan*. Authored by Mark Thomas. Retrieved April 17, 2025, from https://www.townofparadise.com/sites/default/files/fileattachments/public_works_/_engineering/page/39341/paradise_tmp-body.pdf

Town of Paradise. (2024). *2024/2025 paradise community recovery action plan - Working together to rebuild a thriving community*. Retrieved April 17, 2025, from https://www.google.com/search?client=firefox-b-d&q=Paradise+Community+Recovery+Action+Plan+.

Internet Sources

California Department of Insurance: California FAIR Plan. Retrieved April 17, 2025, from https://www.insurance.ca.gov/01-consumers/200-wrr/California-FAIR-Plan.cfm

California Department of Tax and Fee Administration (CDTFA), Fire Prevention Fee. Retrieved January 28, 2024., from https://www.cdtfa.ca.gov/taxes-and-fees/fire-prev-fee.htm

Insurance Institute for Business & Home Safety (IBHS). Retrieved April 18, 2025., from https://ibhs.org/about-ibhs/

Insurance Institute for Business & Home Safety (IBHS), National Fire Protection Association (NFPA) and Wildfire and Research Divisions Verisk Analytics Inc. (2023). *Living with wildfire. Vulnerabilities and readiness across the western United States*. Research Report. Retrieved April 29, 2025, from https://ibhs.org/risk-research/living-with-wildfire/

CHAPTER 5

Necessary, Yet Overlooked: Land Use Control in La Plata Flood Risk Management

Jana Blahak

5.1 Introduction

On the night of 2–3 April 2013, floods caused by torrential rains killed more than 80 people in the Argentine city of La Plata (Cuenca et al., 2016). The catastrophic night became characterised as 'one of the greatest human tragedies in the history of […] the country' (Inundaciones de La Plata, 2019). Initially, when discussing who was responsible for the tradgey after the chaos and deadly effects of the flood, the focus was on the mayor's absence on holiday and the overburdened emergency system (Bruera volvió a usar Twitter, 2017). Only later was more attention paid to the chorus of experts pointing out that the approach to flood risk management[1] of the city had failed on a more fundamental level to reduce pre-existing factors that made residents more vulnerable and exposed to urban flooding (Cuenca et al., 2016, p. 12).

[1] Defined by Schanze (2006) as a 'holistic and continuous societal analysis, evaluation and reduction of flood risk'.

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A major point of criticism was that the approach to flood risk management did not include non-structural measures associated with urban planning. Between 2002 and 2013, the city had been growing significantly, leading to more intensive land use which, in turn, increased the risk of urban flooding by increasing exposure and vulnerability (Karol & San Juan, 2018). Many experts saw adapting the flood risk management strategy to integrate more land use measures in addition to existing flood protection measures (in this case, mainly drainage infrastructure) as necessary to ensure the continued safety of citizens. This call to integrate more land use measures into flood risk management approaches (referred to as 'integrated approach' in this chapter) aligns with the general insight that diverse strategies (adapted to the specific context of the place) can generally be associated with better results in managing flood risk (Hegger et al., 2016).

The failure to establish a more integrated approach that also included non-structural measures in La Plata can be described as a failure by the local public administration to 'adapt and transform to changing socio-ecological conditions' (Kempenaar et al., 2022, p. 2; Hegger et al., 2016). This capacity has been identified as a central aspect of a systems' resilience in both the urban (Therrien et al., 2020; Kempenaar et al., 2022) and flood resilience literature (Hegger et al., 2016; Hannibal et al., 2022). Conversely, these scholars have identified a lack of this capacity as a barrier to achieve the policy objective of a more resilient governance system that is often discused in the framework of efforts to adapt to climate change (cf. Folke, 2006, p. 262).

Yet, while recognising the lack of capacity by public actors to adapt as as an important explanatory factor our understanding of why and how these failures occur in the first place remains limited (cf. Therrien et al., 2020). On the one hand this is related to the vague nature of the concept of resilience as an outcome (see, e.g., Cutter, 2016; Hegger et al., 2016). On the other hand, it is also related to a lack of attention to the processes and dynamics happening inside public organisations (for more see, e.g., Seibel et al., 2017). What speaks for this argument is that La Plata is not unique in experiencing difficulties with the task of integrating flood risk management (even Dutch cities—trailblazers in this area—have been affected; Jong & van den Brink, 2017). Coordination issues in the public sector due to departmental biases and other organisation-specific dynamics have long been recognised as impeding the implementation of integrated flood risk management (i.e. Dieperink et al., 2016), supporting the

argument that the shared issues are related as much to the shared similarities of the organisations trying to reduce flood risk as to the hazards they are facing. However, it is exacting work to disentangle their exact effect in highly complex system. This makes examples that directly examine the role of public policy and public actors in the long-term process of a community adapting to socio-ecological changes rare, but necessary to understand how and when the specific decision-making environment in public organisations is related to adaptation failures (see for a similar argument Biesbroek et al., 2017).

The case of La Plata is particularly well-suited to investigate what makes the task of integrating different measures to reduce flood risk challenging for public officials (van Herk et al., 2011b). First, with the help of secondary literature, expert reports and extensive newspaper coverage, it is possible to trace events and decisions (Beach & Pedersen, 2019; Bennett & Checkel, 2014; Collier, 2011) and show that the communities' high exposure to urban flooding in 2013 was connected to changes in land use. These changes can be directly linked to a sequence of specific bureaucratic decisions and (in)actions (see, e.g., Morosi & Romanazzi, 2018). Second, while the specific sequence leading to this outcome is unique to this case (Blatter & Haverland, 2012), it is possible to draw generalisable insights on the relevant causal mechanisms underlying key decisions by responsible leaders. The case can be described as a most-likely case for an integrated approach to flood risk management, as the city is famous for being a 'planned city' with a strong planning culture (Vértiz, 2019, p. 2469), which should make the strong influence of departmental bias against planning solutions unlikely.

The chapter is structured as follows. First, the 'human' causes for the increasing flood risk and the consequences of not addressing it are introduced. This covers the exact nature of the flood risk in La Plata and how it developed in recent history. Then, the specific features of the flood risk management strategy in La Plata are expanded on, reflecting on the features of the case that make it suitable for the current research. After presenting the sequence of events between 2002 and 2013 (hereafter 'the sequence'), which forms the basis of the analysis, the crucial moments for explaining the outcome are highlighted. Subsequently, building on specific insights about the case and how they relate to broader theoretical ideas, an analysis of the sequence is presented, broadly separated into three parts to address how various causal mechanisms affect responsible public actors' decision-making at critical junctures (Levy & Goertz, 2007).

Finally, the generalisability of the findings is being discussed. Analysing how the flood risk management strategy developed in La Plata over time allows to gain important insights into the nature of the incentives that impact decision-makers besides coordination issues.

5.2 Unaddressed Challenges of Urbanisation

Despite floods being a common phenomenon in the Province of Buenos Aires (Bertoni et al., 2004, p. 18), the flood event during the night of 2 April 2013 in the city of La Plata, Argentina, was an unprecedented meteorological event that exceeded all historical records for La Plata (Liscia et al., 2013, p. 17).

Furthermore, though close to the river delta, the city of La Plata was not built at the mouth of the river but rather a few kilometres inwards, where it is traversed by various small urban creeks that deliver water to the Río de La Plata. It is therefore located in the continental zone, which implies that the creeks and their floodplains (in their natural and later artificial course) would always be the most relevant potential hazard zones during thunderstorms (Kofman & Bejar, 2014).

Yet, while the meteorological circumstances in 2013 were extraordinary, and specific geomorphological features of the land on which La Plata was built further increased the baseline risk, it was the combination of these factors with more 'human' aspects that made the event disastrous for the citizens of La Plata (Liscia et al., 2013). The increased flood risk was linked to the way the city's growth had been managed in the previous decade. During this time, major changes in land use occurred, induced by what can broadly be described as an advancing urbanisation of the area: the La Plata municipality experienced significant population growth between 2001 and 2010 (Andrade et al., 2012, p. 19) and, simultaneously, the surrounding Gran La Plata region experienced an increase in construction (Benítez et al., 2007, p. 178).

The expanding occupation of the floodplains in the Del Gato river basin (Benítez et al., 2007, p. 177) during this time period is particularly significant considering its outsized impact on the safety of residents. The Del Gato river basin was one of the areas with the most economic and social activity, containing rural and urban sectors with a high production, commercial, industrial and recreational value (Romanazzi et al., 2012, p. 440). At the same time, the floodplains in this area absorbed the majority of the rainwater in the urban area of La Plata from smaller creeks

(Rotger, 2018, p. 45). As a result of the increasing urban density in those regions where the risk of flooding was already great due to their geomorphological features, the area's flood risk rose, making living on the land particularly hazardous (Losano, 2011, p. 85). In addition, it also contributed on a more broader level to the catastrophic consequences of the hazardous event in 2013, as summarised by Kruse et al. (2015, p. 29):

> […] water quickly occupied its old courses, now entirely urbanised, and extended towards floodplains, thus flooding many sectors of the city. In addition, the surroundings of La Plata not so long ago sparsely inhabited, have become a fruit and vegetable belt, quite urbanised, and with many greenhouses, which reduced infiltration and increased runoff. Because of this, huge quantities of rainwater from the surroundings of La Plata entered the city, thus rapidly aggravating an already troublesome situation.

5.3 Flood Risk Management Essentials and La Plata as a Most-Likely Case for Integration

Cities worldwide are facing the 'double jeopardy' of climate change and population growth (Froese & Schilling, 2019, p. 26). Current climate dynamics point towards an increase in the number of flood events (Lee et al., 2023); at the same time, more people are moving into flood zones (Rentschler et al., 2023). Yet, cities like La Plata are not powerless in the face of this jeopardy (Herzer & Clichevsky, 2000, p. 33). Governments—especially on the local level, where decisions about land use and the implementation thereof mainly occur (e.g. see Bergsma, 2016, p. 7)—have the option to adapt to emerging changes by using different flood risk management strategies (compare also with the concept of adaptive capacity in the resilience discourse, Hegger et al., 2016, p. 4). The case of La Plata's flood risk management strategy between 2002 and 2013 was selected for this investigation because despite the major changes in flood risk described in the previous section, the city administration did not fundamentally change its flood risk *management* strategy. This raises the question of why relevant local decision-makers did not pursue a more integrated approach, even though it was a known and recommended approach to address the increasing risk of urban flooding (i.e. Jha et al., 2012).[2] In order to address this

[2] In theory, the measures outlined can also be implemented through private actors. The exclusive focus on public actors in this chapter is due to the fact that in 2013 'less than 5% of

question, it is first necessary to look at the broader context of flood risk management in La Plata. This requires first an examination of the extent to which the classical argument of departmental silos in flood risk management, which has been identified as a potential barrier to action (Hannibal et al., 2022), is relevant to understanding the case at hand.

When looking at the local circumstances in La Plata, it is of note that before 2013, no organisation or individual in the administration was given the responsibility of 'managing flood risk' in terms of coordinating different structural and non-structural measures and developing one coherent strategy (Karol & San Juan, 2018, p. XXVIII). The organisations with the most far-reaching authority for reducing flood risk on the local level, the *Dirección Municipal de Hidráulica* (DMH; Municipal Directorate of Hydraulics), and on the provincial level, the *Dirección Provincial de Saneamiento y Obras Hidráulicas* (DiPSOH; Provincial Directorate of Sanitation and Hydraulic Works; Ballari & Plot, 2016, p. 6), were focused on engineering solutions. They paid limited attention to other factors that contributed to what made the community more exposed to urban flooding in 2013, especially changes in land use induced by the rapid and unequal urbanisation process in La Plata (Del Río & González, 2018, p. 218). Conversely, the main organisation responsible for urban planning, the *Dirección Municipal de Planamiento* (DMP; Municipal Planning Directorate of La Plata; Resa & Bozzano, 2014), was focused mainly on the policy goal of helping the city grow—principally in economic terms (Vértiz, 2019, p. 2467).

This observation aligns with broader trends in the field of flood risk management, where traditionally—both worldwide (WMO, 2012, p. 12) and in Argentina (Banzato, 2014)—flooding was regarded as an external problem against which structural (flood defence) measures like dikes and drainage systems would be sufficient to protect citizens (Barrera et al., 2008). Consequently, public organisations most associated with the task to reduce flood risk are often solely responsible for engineering projects (and mainly staffed by engineers; see, e.g., Liefferink et al., 2018; Wiering et al., 2018). Conversely, other instruments focused on flood risk

the total damage […] was insured' (Barachetti, 2016). This hints that the private real estate market did not play a significant role in flood risk prevention through raising the price for insuring floodable land and thereby disincentivising people to construct on it and, in the case of La Plata, squarely puts the responsibility for flood risk management into the hands of the state.

prevention (see Table 5.1), like land use controls, are not prioritised by these organisations because the policies needed to implement these strategies are not in their direct purview in municipalities like La Plata (Carusso, 2007). This separation of responsibility contributes to departmental bias (Gulick & Urwick, 1937).

As has been recognised in various contexts, this type of organisational separation can present a significant barrier to address the challenge of integrated risk management (i.e. Coaffee et al., 2018, p. 404; Hannibal et al., 2022). This was confirmed in the case of La Plata, where the existing organisational separation for flood management did ultimately lead to silos, with the flood management and urban planning domains and policy communities rarely overlapping, thus playing a significant role in impeding increased coordination between the urban planning and flood management policy communities (Morosi & Romanazzi, 2018; AdA, OPDS and DiPSOH, 2012, p. 4).

At the same time, the fact that La Plata is a city with a strong planning history (López & Sager, 2010) makes it a case where introducing more land use controls to manage flood risk is more likely (del Cueto, 2013). Especially in the beginning of the 2000s, the municipal administration had put an emphasis on the maxim of 'participatory planning', with the goal of opening the process to the broader community (Vértiz, 2016, p. 79), making it more likely to overcome potential departmental bias and coordinate better with other relevant actors. A major indicator in this regard was a reform of the urban and land use planning code, the *Código*

Table 5.1 Two types of flood risk management strategies (adapted from Dieperink et al., 2016, p. 4469)

Strategy	*Focus*	*Characteristics*	*Examples*
Flood defence	The focus is to keep water away from people through so-called structural measures	Flood defence measures aim to decrease the probability of flooding areas through infrastructural works	Drainage systems, dikes, dams
Flood risk prevention	The focus is to keep people away from water through so-called non-structural measures	Prevention measures aim to decrease the consequences of flooding by decreasing the exposure of people/property	Urban planning, land use planning, managed retreat

de Ordenamiento Urbano y Territorial (COU), in 2000 (Vértiz, 2016, p. 106) and the strengthening of a participatory advisory board, the *Consejo de Ordenamiento Urbano y Territorial* (COUT), which played a significant role in furthering more integrated strategic planning approaches (Vértiz, 2016, p. 88).

It can thus be concluded that the issues faced by La Plata—which led to traditional structural measures such as drainage systems becoming increasingly insufficient as management strategies for pluvial flooding[3]—mirror the 'double jeopardy' that affects cities worldwide, thereby increasing the exposure of communities to floods. It is the specific planning and administrative history of the municipality described in this section that makes the case of La Plata special, as it allows one to focus on the explanatory factors beyond the classical organisational separation argument to understand why local public administrations do not adapt to predictable changes in the environment.

5.4 Why No Adaptation to the Flood Risk Management Strategy?

To understand the development of La Plata's flood risk management strategy, one should therefore look at the whole sequence of events occurring between 2002 and 2013, with an emphasis on the public decision-makers responsible for developing the city's flood risk management strategy. For this purpose, it is useful to identify critical junctures in the sequence to distinguish when and how important decisions were made (see Fig. 5.1).

Two major flood events occurred during this time span before the 2013 flood: one in January 2002 and another in February 2008. The 'focusing' effect (Birkland, 1998) of the two flooding events and the resulting attention for different ideas regarding the causes and policies generated from it made these two events critical junctures in the sequence. In both instances,

[3] Pluvial flooding is mainly caused by human occupation of natural ecosystems, which decreases the natural absorption of the soil (Rubinato et al., 2013, p. 4). An increased rate of urbanisation close to river systems and on floodplains therefore goes hand-in-hand with an increased risk of flooding. Yet, human settlements are often built in these locations due to the advantages of the land being flat and the proximity to water resources (Rojas et al., 2017, p. 1). These tensions between growing urbanisation (and the related growth needs connected to land use change, such as housing) and the need to reserve land for flood alleviation are at the centre of the discussions around urban flood risk reduction worldwide (UN-Water, 2019, p. 20).

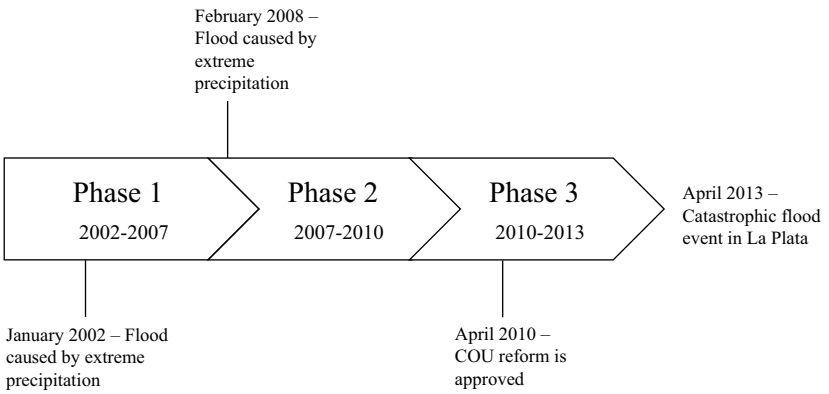

Fig. 5.1 Relevant critical junctures for the flood risk management strategy in La Plata between January 2002 and April 2013 (author's illustration)

attention was brought to the issue and increased pressure on the municipal administration to 'do something' and engage in flood risk management (Birkland, 2006, pp. 17–20).

A third critical juncture in the sequence, different from the previous two, can be seen in 2010: the land use planning code (COU) reform process. The confirmation of the new version of the COU in April 2010 can be framed as crucial in terms of providing the opportunity to significantly change the way land was managed through changing the rules governing this process (Losano, 2011).

In conclusion, the flood events directed ample attention to the widening gap between the growing risk and flood risk management measures and the COU reform process allowed for the approach to flood risk managment to be made more integrative. Still, despite the opportunities for action, the municipal administration did not address the city's increased exposure and vulnerability to urban flooding, and the resulting increased flood risk had fatal consequences in 2013.

The sequence of events at the heart of the case analysis can be broadly divided into three phases, oriented around the critical junctures:

Phase 1 (2002–2007): In January 2002, La Plata experienced a major flood. In response to the event, a crucial planning document was adopted (Liscia et al., 2013, p. 51); this was decisive for the later flood risk reduction strategy of La Plata as the decision signified a strong commitment (in terms of money and attention) to focusing on reducing the deficiencies of the infrastructure.

Phase 2 (2007–2010): In 2007, a municipal election in La Plata resulted in a change of political (and administrative) leadership. After a second impactful flood event in 2008, further structural measures in line with a flood defence strategy were announced and implemented (Liscia et al., 2013, p. 50).

Phase 3 (2010–2013): In 2010, land use was deregulated by reforming the main municipal urban planning regulation, the COU.

In the following analysis, each of these phases will be examined in closer detail. Building on the insight that there were several opportunities to introduce more non-structural flood risk prevention measures, the question of why the flood risk management strategy was not adjusted, even in the face of urban growth, is at the centre of the analysis. For this purpose, actions and decisions by responsible public decision-makers at critical junctures like the flood events will be closely scrutinised with the objective of identifying relevant causal mechanisms explaining their behaviour.

The Path Not Taken

Between 2002 and 2007, there was a good chance for a more integrated flood risk management strategy to be implemented, yet decisions ultimately taken by the city administration made subsequent change in this direction less likely. The adoption of the *Plan Maestro de Obras Hidráulicas del Sistema Hídrico del Partido de La Plata 2002–2007* (hereafter Plan Maestro) after a major flood event created a long-lasting legacy emphasising flood defence (Liscia et al., 2013, p. 51). This strategic document was decisive for the later development of the flood risk reduction strategy for the municipality of La Plata as it signified a strong commitment (in terms of money and attention) to reduce mainly the perceived infrastructural deficiencies and not those that emerged due to changes in land use. Unpacking how this decision came about is therefore central.

At the beginning of January 2002, La Plata was hit by a severe thunderstorm that led to partial flooding of the city. No deaths were officially reported, yet the event exhibited strong similarities to the catastrophic event in 2013 in terms of climatic features and how they interacted with other pre-existing conditions: a large volume of water fell in a relatively short time span, flooding large parts of the city (Fucks et al., 2017, p. 151). The broad newspaper coverage of the event signalled that it was perceived as a serious disruption; the most relevant daily paper in La Plata (Vértiz,

2016, p. 106) stated that 'the city collapsed under the rain' (El agua tapó todo, 2002). It was further noted with concern that the responsible local flood risk governance arrangement (Hegger et al., 2016, p. 58) did not appear prepared for such an event (Morosi & Romanazzi, 2018, p. 92), instilling fear in the local community that similar future flooding would cause more harm (Morosi & Romanazzi, 2018, p. 97).

Initially, the municipality, led by Mayor Alak and his administration, tried to reduce the pressure created by this focus on their capacities and competence by arguing that the storm had been a 'historic event' without precedent, and therefore, people could not expect them to have been able to foresee it (El agua tapó todo, 2002). Conversely, the citizens affected directly by the flooding pointed out that the drainage of the water was markedly slower than during previous floods, hinting at a broader set of causes that connected their higher risk of flooding to the increased density of the built environment (Morosi & Romanazzi, 2018, p. 94).

The topic did not leave the agenda, and it became clear that a stronger signal that the municipal administration would take substantial action was necessary, ultimately resulting in the creation of the Plan Maestro in 2002 (Liscia et al., 2013, p. 52), which the mayor of La Plata (together with the Province of Buenos Aires) presented in the same year. It stipulated various, mainly flood defence, projects to be constructed by 2007 as well as the necessary actions that needed to be taken in advance (like surveying the existing situation). As the construction projects were relatively large scale, such as extending the existing drainage system, responsibility for the construction was mainly with the Province of Buenos Aires (Ballari & Plot, 2016). This Plan Maestro and the creation of the DMH were the main visible policy changes after the flood event in 2002 in the field of flood risk management.[4] Crucially, the Plan Maestro did not specify any

[4] Contrary to this focus on infrastructure by local actors, the national policy discourse developing regarding flood risk management at the time focused on integrating different measures. For instance, in April 2003, the National Government and the Japanese Government jointly introduced a document emphasising the importance of prioritising the implementation of non-structural measures as relatively immediate solutions (Giménez et al., 2003). At the same time, another disastrous flood occurred in Argentina: the Argentinian city of Santa Fe experienced a historic flood in April, where at least 22 people died (International Federation of Red Cross and Red Crescent Societies, 2004). The event was a stark reminder that structural measures can never guarantee total safety as there always remains the chance for an event to surpass historic values (which is what also occurred in 2013). In this light, it was underlined again that non-structural measures that incorporate

non-structural measures (Carusso, 2007) towards stricter land use controls, and the DMH was only responsible for hydraulic measures.

The fact that more non-structural measures like land use controls were not announced in the first phase of the sequence is surprising insofar as the conditions in this phase were perhaps the most receptive for a more integrated approach (van Herk et al., 2011a, p. 543). As already mentioned, Mayor Alak and his administration had been actively pushing a revised planning code, which promised to be more integrated and was implemented in 2000 (Vértiz, 2019, p. 12), prior to the flood event in 2002. Through the newly introduced COUT advisory body, the DMP was forced to place all urban planning actions in a broader strategic context in an attempt to balance out economic, social and environmental interests by bringing all interested parties to the table (Resa & Bozzano, 2014, p. 4). Therefore, in the case of a flood—such as the 2002 event—highlighting the increased flood hazard created, in part, by the existing land use strategy one would expect that the COUT would recommend the DMP to adapt their planning strategy. However, based on the available sources (which do not include a complete collection of meeting minutes), this did not occur. While municipal and provincial organisations recognised that 'urban growth for the area has clearly exceeded forecasts' (Morosi & Romanazzi, 2018, p. 107), responsible municipal actors failed to consider the consequences for their general planning strategy beyond expanding the drainage system (Morosi & Romanazzi, 2018, p. 105). Possible explanations for this course of action, leading to the Plan Maestro, are explored next.

A first important element to uncovering possible explanations is the insight that the novel 'participatory planning regime' in La Plata fostered *un*equal access to decision-making. The COUT advisory body was not accessible to all in the same way, with less resourced groups—which was often true for those citizens directly affected by the flood[5]—being disadvantaged (Rusconi, 2019; Vértiz, 2019, p. 16).

flood risk in land use plans can be a vital step in reducing the vulnerability of the community and the lethality of the event (Negri & Zagalsky, 2005).

[5] Research in general shows that a lower socio-economic status makes individuals more vulnerable in terms of the consequences of the flood and recovery capacities and their ability to participate in decision-making processes (Thomas et al., 2019). In La Plata, the observed population and real estate boom first led to households with less resources being pushed onto land with a higher flood risk because it was the only land that was accessible (Del Río & González, 2018). For example, in their study of a certain part of Ringuelet, Benítez et al.

It is likely that this unequal distribution of access had an effect on decision-makers in the DMP and the mayor, as the actors responsible for strategic planning. Underlying this proposition are the assumptions that decision-makers have limited cognitive resources (Simon, 1997), making 'attention and search processes […] neither costless nor complete', and that they make decisions based on 'satisficing rules of selection' (Zahariadis, 2016, p. 157). One can expect that they would first turn to the information readily available to them in the COUT when making decisions regarding the city's urban planning strategy (which does not include those opinions by less-resourced actors). Subsequently, if the available information satisfied most demands, decision-makers would not go beyond existing ideas like addressing the differential vulnerability by different minorities.[6] It can be presumed that those regarded as relevant (and permitted access to relevant decision-making bodies) were not consciously picked out by the municipal administration. If the administration had strategically decided to not engage with specific groups, one would expect to find no efforts to engage with these groups. Yet at this stage, the Alak administration exhibited willingness to engage with the groups affected by flooding (Rusconi, 2019), even going so far as to attend neighbourhood meetings to speak with people directly (Morosi & Romanazzi, 2018, p. 98). There is only scarce evidence for the assumed causal mechanism in this case study. However, the theoretical certainty (Beach & Pedersen, 2019, p. 155) of the idea of *bounded rationality* and its consequences are well documented (i.e. Gigerenzer, 2020).

In addition to unequal access creating a biased decision-making environment, further factors motivated the decision to focus exclusively on flood defence strategies.

Since structural measures as part of a flood defence strategy are perceived as the 'safe' and 'stable' solution in 'countries were flood defence plays a consistently dominant role' (Wiering et al., 2018, p. 232), such as Argentina, it can be assumed that decision-makers were also influenced by

(2007, p. 182) were able to observe an increase in exposure to floods for low- and lower-middle-income population. Informal settlements on floodplains were disproportionally vulnerable to floods in terms of land use in two ways: (1) they were the first affected due to their location; and (2) they lived in 'unplanned' spaces with only limited drainage infrastructure (WMO, 2012).

[6] The informal access granted to the mayor's office for groups affected by flooding at various points between 2002 and 2013 only was possible after protests and had no concrete results in terms of changes in the flood risk management strategy (Rusconi, 2019).

what Argyris (1986) called *defensive routines* (ibid., p. 318), in which responsible decision-makers aim to prevent potential embarrassment or risk for their organisation. Preliminary evidence for this link is that decision-makers did not act proactively to prevent flood damage, even though expert testimony (Hurtado & Giménez, 2006) and critical voices urging for more integrated environmental planning were present inside the COUT (i.e. CPCN, 2009). This explanation also fits in with the volatile economic and political situation in Argentina (Grugel & Riggirozzi, 2007), which contributed to a desire by public officials for stable 'safe' solutions.

As a small preliminary conclusion, we can say that the scenario that most likely explains the decision-making process leading to the specific form of the Plan Maestro based on the available evidence is that decision-makers between 2002 and 2007 had knowledge about alternative available strategies to address flood risk through land use planning. However, they did not prioritise these strategies due to those constituents most directly affected by the flooding not being heard in the COUT and an awareness that other available strategies were already tried and tested and, therefore, would result in less potential embarrassment in a volatile political situation. Of course, there are many other factors that explain the specific form of the Plan Maestro; however, this chapter focuses narrowly on those factors explaining why land use controls were not included.

It is prudent to shortly discuss the impact of the Plan Maestro over time at this point that goes far beyond the first phase of the sequence. Without the benefit of hindsight, one could have argued that a partial solution like the Plan Maestro is not a bad outcome. However, the path dependency created for the floodrisk governancearrangement (Hegger et al., 2016, p. 58) made a later shift of strategy less likely; the Plan Maestro bound significant resources for structural projects, making later change more difficult, even with floodrisk increasing. created for the flood risk governance arrangement (Hegger et al., 2016, p. 58) made a later shift of strategy less likely; the Plan Maestro bound significant resources for structural projects, making later change more difficult, even with flood risk increasing.

The effect of these legacies becomes clearer when looking at the implementation process, where experts suggested that further measures to reduce the emerging flood risk were necessary but were only partially listened to. The municipality signed an agreement in July 2003 with the Faculty of Engineering of the National University of La Plata (Liscia et al., 2013, p. 27) to collect data. The first phase of this programme, a study of

the Del Gato creek, was put into action. The results were presented to Mayor Alak in August 2004, outlining different measures that would reduce exposure and vulnerabilities connected to land use existing in the northern zone of the La Plata municipality. In response to this report, the municipality promised 'to create a hydraulic and hydrological operation and monitoring module and warning system in the Del Gato basin […]' (Pagni, 2013), thereby following the path already outlined by addressing the emerging problems with structural measures. In the second installation of the report on the Del Gato river basin, which was presented to the municipality in June 2005 and was already building on the newly collected data, the researchers came to the conclusion that the drainage system of the city had not expanded in a time where the city itself had experienced significant growth (Morosi & Romanazzi, 2018, p. 105), which made people more exposed to hazardous floods. On the provincial level, the DiPSOH came to a similar conclusion, stating that 'urban growth for the area has clearly exceeded forecasts' (Morosi & Romanazzi, 2018, p. 107). Yet, this and other similar insights that suggested that non-structural measures should also be considered in addition to the original Plan Maestro were not incorporated by the municipal administration.[7]

In summary, in this first phase of the sequence, there are multiple factors that explain why a more integrated approach to flood risk management was not pursued. There was an implicit bias in the information available to decision-makers that was created by unequal access to important decision-making venues in the planning sector. This resulted in less information for decision-makers about the potential of non-structural measures such as land use controls. Furthermore, it is likely that the adoption of structural measures was perceived as safer in terms of resulting in

[7] For example, the 'environmental analysis for the municipality of La Plata' presented in 2006 by the *Instituto de Geomorfología y Suelos de la Facultad de Ciencias Natural y Museo* (CISAUA; Institute of Geomorphology and Land) did not have any traceable effect on the administration's strategy. It was commissioned as a contribution to a more general territorial planning strategy by the Province of Buenos Aires, the federal investment council and the municipality of La Plata. It directly spoke to the links between land use degradation (connected to urban processes), urban planning practices and flood risk. The conclusion reached by the experts was clear: 'The main problems caused by floods are derived from the anthropogenic occupation of areas with high water risk. Facts such as poorly located neighbourhoods; inadequately designed infrastructure […] among other examples, indicate ignorance about water risk in planning and the subsequent aggravation of the consequences of floods'. Furthermore, in their recommendations for actions, an integral programme for territorial planning is emphasised (Hurtado & Giménez, 2006).

less political pushback (Bergsma, 2016). Subsequently, the Plan Maestro was framed as a first step that could lead to a more integrated approach to flood risk management in the future (Ran & Nedovic-Budic, 2017). However, in hindsight, it becomes clear that the path dependencies created by the Plan Maestro had substantial influence in a different direction, setting the municipal and provincial institutions on a path of flood defence (Pierson, 2000) and thereby implicitly deprioritising flood prevention.

Real Estate Lobbying and the Obstruction of Land Use Control

Another window of opportunity opened up in the second phase of the sequence. Even though the new administration ultimately did not take advantage of this opportunity, preferring to retain focus exclusively on planned structural measures, it is important to trace the underlying mechanisms because the outcome was not fully predetermined (Mayntz & Scharpf, 1995). The analysis of relevant decisions at the critical juncture reveals additional psychological mechanisms and other more consciously employed political strategies as further explanations for the decision to not apply planning controls as flood prevention measures. Both will be discussed in more detail in the following section.

When looking at the beginning of the second phase, the configuration of two contingent events deserves particular mention: another flood event and local elections. Intense rainfall between 28 and 29 February 2008 re-exposed the city to prolonged rainfall, causing flooding, especially in the northern outskirts of La Plata (Romanazzi, 2014, p. 5). With the Plan Maestro already in place, producing significant sunk costs in the form of (promises for) large investments in flood infrastructure (Wiering et al., 2018, p. 232), one would expect limited 'room to manoeuvre' (Mayntz & Scharpf, 1995, p. 52) to introduce new, non-structural measures. However, the flood event occurred shortly after a local election in 2007, so the new incoming city administration had an opportunity to change the flood risk management strategy after the flood, especially since more reports produced evidence that the flood damage was causally connected to changes in land use exacerbated by 'human intervention' (in terms of increased land occupation; Hurtado & Cabral, 2008, p. 76). Looking at the end of phase two, the opposite happened: the new mayor Bruera did not denounce his predecessors' strategy to manage the flood issue and did not consider more non-structural measures (Morosi & Romanazzi, 2018, p. 116). To understand why, several factors have to be considered.

First, the fact that the Bruera administration had just come into power also meant that they could not be blamed (directly) for inadequacies of the current municipal flood risk management strategy exposed by the flood event (Hood et al., 2001). Without a contradicting track record, they felt less incentive to do something about this issue than the Alak administration, to which most of the blame had accrued, and they could voice strong opinions about what should be done (Morosi & Romanazzi, 2018, p. 116). Also, at first, Bruera took the lead and wanted to make the reports created by the National University of La Plata an 'executive project', asking for additional money from the Province of Buenos Aires after the 2008 flood (Morosi & Romanazzi, 2018, p. 117). Such a project might have developed into a more integrated flood risk reduction management strategy for the city; however, the provincial government signalled that there was no money for it. Also, crucially, Bruera was shown data on the relative low probability of another flood happening (once in 100 years), which, according to some sources, caused him to lose interest in the topic (Morosi & Romanazzi, 2018, p. 117). While exactly what the strategy would have looked like cannot be traced, what happened was that the mayor regarded the provincial government as the actor that should continue to be active in this area.[8] This proved to be a misjudgement of the situation as the increase in risk could mainly be attributed to changes in land use, which can be best addressed by flood prevention measures, which were under the purview of the city, not the provincial administration; this was later reiterated by a court (Concejo Deliberante La Plata, 2010). In addition, it is likely that Bruera was influenced in this case by *present bias*, which is the 'tendency to place a higher value on the present time over any future time' (Linnemayr et al., 2016, p. 770). Present bias works against individuals prioritising preventive actions, as these have 'immediate costs, but unclear or delayed benefits, as the likelihood of a disaster event is low and the timing is unknown' (Linnemayr et al., 2016, p. 770), thereby making it more

[8] Various initiatives to reduce flooding were launched: the Governor declared a one-year 'water emergency' for the whole Province of Buenos Aires on 18 March 2008 (Gobernador de La Provincia de Buenos Aires, 2008). In this decree, the Province acknowledges, inter alia, the necessity 'to carry out actions and works to improve the water flow capacity of canals and streams, improve drainage and protection of urban areas and primary emergency care' for the municipality of La Plata and identify the necessary funds. Within this framework, DiPSOH commissioned four (private) consulting firms to survey and carry out executive or tendered works in the basins of the Maldonado, Rodríguez and Del Gato, further doubling down on the 'infrastructure path' to protect against flooding (Liscia et al., 2013).

likely to overestimate the acceptability of a given risk and prioritise other goals. Even though the risk of an extreme event was relatively low (Liscia et al., 2013, p. 17), the consequences of such an event were severe, making actions to prevent such a 'black swan' event still necessary but easy to dismiss (Taleb, 2007).[9]

A final crucial factor that helps clarify why the new administration did not pursue land use controls as a strategy to reduce flooding is how the Bruera administration came to power. Bruera had already competed for the position of mayor of La Plata in 2003 and, despite losing at the time, used the opportunity to build an alternative platform from which he was able to successfully weaken the Alak administration, leading to his election in 2007. One crucial base of support for him was the real estate sector, which, among other grievances, felt excluded from the COUT advisory body since its inception (Vértiz, 2019, p. 14). The sector's argument against the then-existing institutional arrangement in the urban planning domain was that what was agreed on in the COUT and codified in the COU limited the supply of urban land. It claimed that this artificially pushed up the price of land, causing buildings and living spaces to be more expensive (Vértiz, 2016, p. 108). In other words, it argued for less state control of urban land in order for the economy to grow. And even though it did not explicitly have the flood issue in mind, this demand for less control also had implications for flood risk management. The large impact of the real estate sector was further exacerbated by another structural factor: municipalities in general largely depend on money and resources from the private sector to implement their policy programme (Birkland et al., 2003; Penning-Rowsell, 1996, p. 85). This was especially relevant in La Plata, where the real estate sector was one of the most important economic sectors between 2002 and 2013 (Losano, 2011).

After Bruera's successful election campaign, a re-arrangement of the urban planning sector occurred that reflected the new alliances. The COUT and the ideas it represented were progressively relegated to the margins (Vértiz, 2019, p. 14). The COUT only met sporadically in 2008 and 2009 until it was suspended (Vértiz, 2016, p. 110; more on this later).

[9] Black swan events are 'highly improbable but highly consequential', which presents a danger in terms of risk perception (and the capacity to act on it), because of the human tendency to overlook extreme values due to their improbability (Taleb, 2007). It is difficult for humans to grasp the concept of statistical insignificance, which is often falsely equated with the significance and impact the event may have nonetheless (Seibel et al., 2017).

This presented a formalised exclusion of critical voices from the decision-making process, which, though also flawed, had been an outlet for different voices being heard when making planning decisions (Vértiz, 2016, p. 16). At the same time, the municipality allowed other groups from the real estate sector deep access to the decision-making process, leading to what Selznick (1949) calls a *co-optation* of the urban planning administration by, among other things, inserting individuals with the same policy goal into the administration (Vértiz, 2016, p. 109). How this power shift impacted decision-making became visible when in 2008, Bruera was handed the final report of the Del Gato river basin, produced as part of the agreement between the National University of La Plata and the city's administration (Morosi & Romanazzi, 2018, p. 108).[10] The report would have been in the purview of the DMH a year before; however, Bruera had decided to not appoint a new head for the institution (practically eliminating it), instead transferring the flood portfolio to the *Director General de Obras Públicas* (Director-General of Public Works). The strategic outlook of this department, while on a higher level in the administrative hierarchy (Morosi & Romanazzi, 2018, p. 107), was closely aligned to the real estate sector. This probably contributed to the report not visibly influencing the flood risk management strategy in terms of implementing more flood prevention measures.

What became more and more visible at the end of the second phase is that the Bruera administration was not interested in addressing the land use changes contributing to the increased exposure to urban flooding (Morosi & Romanazzi, 2018, p. 128). Therefore, any proposals trying to go beyond structural measures (initiated in most cases by the Province of Buenos Aires) became difficult to implement. This also partly explains why the initiatives by the state water authority, *Autoridad del Agua* (AdA),[11] which were more in line with an integrated flood risk management strategy, were not effective. For example, the *Comité de (la) Cuenca Intermedia de Vertiente Río de La Plata* (roughly translated as Committee for the

[10] In this document, the authors coincided with the diagnostics of the 2006 CISAUA report and recommended (once again) additional measures to maintain and improve the drainage system, urging that the then-existing rainwater drainage system would not be sufficient for 'low-recurrence storms' (Romanazzi & Urbiztondo, 2007).

[11] This agency was created as 'an autarchic entity of public law and transdisciplinary nature' (Cuenca et al., 2017, p. 7). It was responsible for defining water resources policy, regulating water use and promoting resource management in the Province (Foster & Garduño, 2002, p. 2).

River Basin of the La Plata River) was established in 2008 (with all the administrations of the affected municipalities in the Gran La Plata Region as members). Its primary mission was to 'establish an integrated water management plan' for the Gran La Plata region (Morosi & Romanazzi, 2018, p. 122). However, the relevant municipal actors did not cooperate and the committee only convened once more until the flood in 2013 (Cuenca et al., 2017, p. 25), with the mayors of the three districts in the Gran La Plata region only formalising it at the end of 2013 (Morosi & Romanazzi, 2018, p. 141 f.). Similarly, a 2012 AdA initiative encompassing more activities related to water governance and discussions of different flood risk management strategies had a limited impact and no willing municipal partners (Morosi & Romanazzi, 2018, p. 131).

To conclude, in addition to the legacy of promises made to invest more in flood defence from the first phase, the political landscape for decision-making fundamentally shifted in the second phase of the sequence. Direct pressure by interest groups from the real estate sector to move away from engaging more actively in strategic land use planning beyond economic development was exerted on the La Plata municipality. At the same time, local public leaders still had opportunities to address the increasing risk but chose not to do so, a decision that was facilitated by elections that allowed for the blame for potential negative consequences to be shifted to the previous administration (compare with Hood, 2011) and because they misjudged the nature of flood risk (compare with Slavíková et al., 2019).

Beyond Technicalities: Urban Planning in Public Discourse

In this section, the critical juncture at the centre of the analysis is not a flood event but the implementation of the plan by the Bruera administration to reform the local code for urban planning (the COU) again. While the content of the reform only had a limited effect on the 2013 flood risk, the reform *process* is relevant as it represented a highly polarised discourse on the general purpose of the COU. Therefore, it was also an opportunity to reform the planning approach to flooding. Yet, at the end of the process, the discourse in the urban planning domain was further narrowed down, with less possibilities for participation and a clearer emphasis on the liberalisation of rules, which will be analysed in more detail in this section.

As already shown, Bruera's administration was supported by the real estate sector, which was in favour of a more liberal approach to urban planning; it is therefore not surprising that the administration focused its efforts in the urban planning domain on liberalising the existing urban planning code (Vértiz, 2016, p. 110). Yet, the first attempt to replace the COU in November 2009 failed due to political disagreements inside the

incumbent party about the process that such a reform could follow (Morosi & Romanazzi, 2018, p. 124 f.). The administration's effort to change one of the most relevant municipal norms did not go unnoticed. An ad-hoc assemblage of various active organisations ('environmental NGOs, union representatives from the Association of State Workers and the Central of Workers of Argentina'; Vértiz, 2016, p. 129) came together at the end of 2009 to, among other things, reach out to the administration to try to make the process more accessible to a broader public (Concejo Deliberante La Plata, 2010).[12] One of their demands was that the reform of the COU would be discussed more broadly in a participatory advisory body (compare with Vértiz, 2016, p. 120).

However, the opposite happened. Despite (or maybe due to) the opaque and fast reform process, the incumbent administration was able to approve a reformed COU (Ordinance N° 9231) in the local legislative body on 28 April 2010. The organisation that had been charged with rewriting the COU was not opened to a broader group of interests (Vértiz, 2016, p. 110), and the COUT, where decision-making had been based on a broader group of interests, was ultimately replaced by a far less participatory body (Vértiz, 2016, p. 113). The administration justified this process as necessary, declaring the reform of the COU a highly technical issue (Revisa la Ciudad, 2009); thus, the new organisation would only need to include those affected by the technical problems (Vértiz, 2016, p. 114). At the same time, it is also true that through the 'restructuring of the institutional arrangement', the Bruera administration achieved the exclusion of voices that might have expressed criticism of their reform objective (Vértiz, 2016, p. 111). In this regard, Vértiz (2016, p. 110) reasons that the municipality could have also used the established COUT to prepare the reform and precisely opted against this possibility due to critical voices present in the COUT.

There were dissenting voices like the La Plata 'College of Architects', who wrote an open letter addressed to the local administration arguing that while they recognised the necessity of modernising the COU, this process required a municipal government able to act as a steward, ensuring that all members of the community would be included in the development process (Concejo Deliberante La Plata, 2010). The president of the

[12] *Defendamos la Ciudad de La Plata* (Let's defend the city of La Plata; https://defendamoslaplata.blogspot.com/) is the platform of social organisations formed to protest against the new COU.

environmental non-governmental organisation *Nuevo Ambiente* also highlighted that 'it is necessary to think of the city in an integrated way' to ensure its sustainable development (Concejo Deliberante La Plata, 2010). However, given that they were not members of an advisory body anymore, both had fewer opportunities to affect public decision-making.

Nevertheless, the actual impact of the content of the new COU[13] was limited as the reform took place not long before the 2013 catastrophic flood event and the changes were only beginning to have an influence on the situation on the ground.[14] Yet, due to the chosen reform process, the atmosphere between the local bureaucracy and most actors in the urban planning domain became tense. The only way a (contested) solution for the COU reform was ultimately achieved was by employing an external actor—the Supreme Court of the Province of Buenos Aires (Morosi & Romanazzi, 2018, p. 124), which confirmed the reform against several lawsuits levelled against the administration from civil society (Vértiz, 2016, p. 114; Morosi & Romanazzi, 2018, p. 127). It can be safely assumed that in this *polarised atmosphere*, any possibility for change towards an integrated system that would require substantial cooperation between all actors involved was eliminated (cf. van den Ende et al., 2023).

In addition, with the Bruera administration ultimately succeeding in implementing their vision for the COU, it is highly likely that their *framing* of urban planning as a technical (and not political) process became more dominant (compare the concept of discourse power by Hajer & Versteeg, 2005). In other words, framing the planning process as an exclusively technical issue was an effective political strategy to achieve the reform effort. However, it is likely that this strategy also further obscured the causal link between the increased exposure and vulnerability to flooding in certain areas and certain types of land use. Furthermore, addressing these issues requires a political process, rather than a technical one, that

[13] The major line of criticism was that the liberalisation of the planning code would mean the destruction of the architectural heritage of the city of La Plata (which was also connected to the protection of 'green spaces' in the city) (Concejo Deliberante La Plata, 2010). Ancillary to this were concerns about the negative consequences of the lack of regulation with regard to real estate activity and the changes in land use it produced (Vértiz, 2016, p. 120).

[14] It only came into force in late 2011, after an extended judicial process involving the municipal administration, the provincial government and the Supreme Court of the Province and was changed various times during this time (see, e.g., Suprema Corte de Justicia de la Provincia de Buenos Aires, 2011).

balances the priorities of different sectors (like economic development and flood risk). The exclusive focus on technical issues in planning ultimately made it more difficult to address the emerging risks related to urban flooding (Dieperink et al., 2016, p. 4469). While it is difficult to find direct evidence for this mechanism (which is about *not* perceiving something), the fact that the municipality made no significant attempts to introduce further urban planning initiatives[15] to address the causes of the flood risk during this time period appears to make this interpretation plausible.

In many ways, the reform of the COU and its consequences for how the issue of managing flood risk was treated in La Plata can be understood as a culmination of dynamics that had already started in 2002. Institutional flood risk management had become more locked into flood defence. The planning domain was partly co-opted by the anti-regulation real estate sector, culminating in the reform of the COU, which dominated the planning process through a very technical framing. This impeded local actors in addressing difficult political issues that required a strategy change, like the rising flood risk caused by the city's recent growth.

5.5 The Quest for Municipal Leadership

To reiterate, the objective of this chapter is to better understand why, in the case of La Plata, an integrated flood risk management strategy combining flood defence and flood prevention measures was not implemented between 2002 and 2013 despite the fact that it could have helped to ensure the safety of the citizens (i.e. Hurtado & Giménez, 2006; Romanazzi et al., 2012) and that there were several points in the process when such a change could have been reasonably initiated.

The most straightforward explanation provided by the relevant literature is that horizontal specialisation in public administrations specific to flood risk management caused 'departmental bias', leading to flood risk management being addressed as mainly an infrastructural challenge and other measures, like land use controls, not being considered (Coaffee et al., 2018; Hannibal et al., 2022). At first glance, La Plata seems like a textbook case for this explanation, with flood defence and flood prevention rarely considered together by the responsible public actors and with

[15] In 2010, a new neighbourhood alert system programme was introduced by Bruera. However, this programme was quickly terminated due to slashed funds (Morosi & Romanazzi, 2018, pp. 128–130).

no single actor responsible for flood risk management (AdA, OPDS and DiPSOH, 2012, p. 4).

However, the conducted analysis shows that this explanation is not sufficient. Between 2002 and 2013, there were windows of opportunity (especially for the mayor as the head of the administration) for implementing a more integrated flood risk management strategy despite the existing departmental bias.[16] Yet in the end, no official comprehensive environmental and urban planning strategy was developed (del Cueto, 2013) and vulnerability and exposure to urban flooding was high when the city was hit by a powerful thunderstorm in 2013 (Cuenca et al., 2017).

This makes it necessary to look beyond this 'classical' explanation towards additional causal mechanisms to explain La Plata's administrative flood management failure. An initial additional factor is the path dependency created by early strategic decisions regarding flood risk management, such as the adoption of the Plan Maestro. While this decision did not directly lead to the outcome in 2013, it influenced the institutional framework in which public actors subsequently made decisions regarding flood risk management in La Plata.

Furthermore, the analysis allowed to investigate the specific mechanisms that impacted public leaders at relevant critical junctures. Since an integration of more land use measures to reduce flood risk in La Plata would require substantial change in overall municipal strategy, associated with higher transaction costs (Hegger et al., 2016, p. 23), a high-level proponent like the mayor is required to implement such a change. However, at the critical junctures created by the floods in 2002 and 2008, psycholgical mechanisms (defensive routines, wrong assessment of risk) incentivised the responsible mayors to prioritise the status quo and stability over the potential gains of a more integrated management strategy.

Moreover some of the groups persistently advocating for a more comprehensive flood risk management approach due to being acutely aware of the flood risk to which they were exposed to, were not meaningfully included in the decision-making.[17] It is likely that this impacted how

[16] Created by, among others, repeated flood events that provoked people affected by the floods to directly experience that the observed land use changes in their urban space also increased flood risk (Andrade et al., 2012, p. 20).

[17] The floods did not affect these specific groups by chance: 'floodable land' is cheaper, because of the known hazard risk (and is still unoccupied) and therefore popular for construction with the most marginalised groups of the community. In the period between 2001 and 2010, demand for this land rose because the 'significant expansion of real estate supply

decision-makers perceived the urgency of different needs (Cuenca et al., 2017, p. 5), reinforcing the perception that the increase in flood risk that emerged due to change in land use is not a priority.

At the same time, actors from the real estate sector progressively gained more power in relevant municipal organisations responsible for planning, partially co-opting the local public administration (Vértiz, 2019). The policy goal of the private actors in the real estate sector in this domain was aligned with their economic interests: in simple terms, eased access to more land that would allow their business to grow. Consequently, from their perspective, non-structural measures in terms of land use strategies to reduce flood risk were not desirable as they would signify a limitation on growth or at least a critical state supervision of their activities. Therefore, while not actively working to hamper activities to reduce flood risk in general, the power of the real estate sector steered the policy discussion in this domain towards measures that could further stimulate growth, which were often in conflict with flood risk prevention strategies. In the end, it can be argued that, counterintuitively, the 'participatory approach' to planning practices in La Plata in the beginning of the sequence made a more integrated approach to flood risk management less likely by biasing the municipal administration's decision-making towards specific interests, which became more formalised after the change in local government in the middle of the sequence.

Finally, the reform process of the COU in 2009/2010 led to a polarised atmosphere between relevant local actors in the administration and civil society that made the cooperation needed for implementing an integrated approach to flood risk management very unlikely. In this process, the administration's insistence that urban planning was a technical issue made it difficult for those most affected by the flooding to broach the issue of the political and social implications of a liberalised planning process.

In hindsight, it is clear how the described decisions ultimately contributed to a flood risk management strategy that did crucially not take into account a significant increase in exposure to urban flooding that emerged due to changes in land use created by the city's growth. However, besides strategic calculation, it is necessary to also consider the context in which these decisions were made in Argentina—it was a time where, after a

[…] prices of [other] real estate rose and there was an increase in urban informality […]' (Del Río & González, 2018, p. 210).

substantial national economic crisis causing political turmoil, stability was prized (Grugel & Riggirozzi, 2007) which was probably further reinforced by common psychological biases like the present bias (Linnemayr et al., 2016, p. 770). It would be interesting to further explore the impact of this national political climate in the future.

In conclusion, the analysis demonstrates that the drafting and implementation of an integrative municipal flood risk management strategy is a challenge for public leaders and other relevant public decision-makers that goes beyond finding the right technical solutions. The findings also show that it is possible to identify various causal mechanisms with the help of known public administration and public policy theories (i.e. Pierson, 2000; Selznick, 1949; Hajer & Versteeg, 2005) that can be generalised as barriers for communities to adapt towards a more integrated strategy.

Considering again the described overlap between the subject of integrated approaches to flood risk management and resilience as a policy goal (Birkmann & von Teichman, 2010), the identification of these barriers also allows to better understand the specific nature of the challenges resilience as a policy objective entails for local public actors (Coaffee et al., 2018). The insights into the relevant causal mechanisms gained in the case of La Plata indicate that decision-makers should not ignore the risk zones characteristic of public administration when faced with the changes brought about by growing populations and climate change.

While these mechanisms must always be understood in their specific context (Biesbroek et al., 2017, p. 67), the notion that cities 'do not develop themselves' (Vértiz, 2016, p. 113) but are rather the result of socio-ecological interactions that can be identified and planned for in advance represents a promising avenue for preparing future policymakers. Taking the fundamentally social nature of the problem into account from the outset can make a difference to policymakers as they tackle the task of managing risk in the face of changing socio-environmental circumstances. They will not only consider what convinces technical experts, but also plan for potential (contentious) social impacts and organisational dynamics. In other words, precisely because La Plata's high exposure and vulnerability to urban flooding in 2013 was partly the result of conscious decisions by public actors means that a different outcome is possible. This potential for change became visible in La Plata itself after the 2013 flood event, when a comprehensive integrated flood risk management strategy *was* developed with the support of relevant social actors (Karol & San Juan, 2018).

References

Andrade, M. I., Lucioni, N. C., & Iezzi, L. E. (2012). Factores de riego hídrico en el Gran La Plata, Argentina. In *IX Jornadas Nacionales de Geografía Física 19 al 21 de abril de 2012 Bahía Blanca, Argentina*.

Argyris, C. (1986). Reinforcing organizational defensive routines: An unintended human resources activity. *Human Resource Management, 25*(4), 541–555. https://doi.org/10.1002/hrm.3930250405

Ballari, A. P., & Plot, B. (2016). *Análisis de los instrumentos normativos de ordenamiento territorial sobre planicies de inundacion en el municipio de La Plata*. Caso de estudio: Arroyo El Pescado. Paper presented at the XVIII Jornadas de Geografía de la UNLP.

Banzato, G. (2014). Políticas públicas ante el cambio climático en un contexto de crecimiento económico: Construcción de una agencia estatal para paliar las inundaciones en la provincia de Buenos Aires, 1870–1910. In *IV Congreso Latinoamericano de Historia Económica 23 al 25 de julio de 2014 Bogotá, Colombia*. Universidad de Bogotá.

Barachetti, A. (2016). *Staying afloat—Flood risk in Argentina*. Swiss Reinsurance Company Ltd..

Beach, D., & Pedersen, R. B. (2019). *Process-tracing methods: Foundations and guidelines*. University of Michigan Press.

Benítez, M., Botana, M. I., Galarza, L., & Ballari, A. P. (2007). Transformaciones territoriales en áreas de riesgo de inundación. El caso del Arroyo El Gato. Partido de La Plata. Período 1980–2004. *Geograficando, 3*(3).

Bennett, A., & Checkel, J. T. (2014). *Process tracing: From metaphor to analytic tool*. Cambridge University Press.

Bergsma, E. (2016). Changed knowledge requirements for spatial flood governance. *Ecology and Society, 21*(4). https://doi.org/10.5751/ES-08952-210440

Bertoni, J. C., Ambrosino, S., Barbeito, O., Daniele, A., Maza, J. A., & Paoli, C. U., Serra, J. J. (2004). *Inundaciones urbanas en la Argentina*.

Biesbroek, R., Dupuis, J., & Wellstead, A. (2017). Explaining through causal mechanisms: Resilience and governance of social–ecological systems. *Current Opinion in Environmental Sustainability, 28*, 64–70. https://doi.org/10.1016/j.cosust.2017.08.007

Birkland, T. A. (1998). Focusing events, mobilization, and agenda setting. *Journal of Public Policy, 18*(1), 53–74.

Birkland, T. A. (2006). *Lessons of disaster: Policy change after catastrophic events*. Georgetown University Press.

Birkland, T. A., Burby, R. J., Conrad, D., Cortner, H., & Michener, W. K. (2003). River ecology and flood hazard mitigation. *Natural Hazards Review, 4*(1), 46–54. https://doi.org/10.1061/(asce)1527-6988(2003)4:1(46)

Birkmann, J., & von Teichman, K. (2010). Integrating disaster risk reduction and climate change adaptation: Key challenges—Scales, knowledge, and norms. *Sustainability Science, 5*(2), 171–184. https://doi.org/10.1007/s11625-010-0108-y

Blatter, J., & Haverland, M. (2012). *Designing case studies: Explanatory approaches in small-n research.* Palgrave Macmillan.

Coaffee, J., Therrien, M.-C., Chelleri, L., Henstra, D., Aldrich, D. P., Mitchell, C. L., Tsenkova, S., Rigaud, E., & the participants. (2018). Urban resilience implementation: A policy challenge and research agenda for the 21st century. *Journal of Contingencies and Crisis Management, 26*(3), 403–410. https://doi.org/10.1111/1468-5973.12233

Collier, D. (2011). Understanding process tracing. *PS. Political Science and Politics, 44*(4), 823–830. https://doi.org/10.1017/S1049096511001429

Cuenca, A., Lozano, S., Branca, M. V., & Cleve, A. (2016). Las inundaciones en La Plata, Berisso y Ensenada: Análisis de riesgos y estrategias de intervención. In *V Encuentro Latinoamericano de Metodología de las Ciencias Sociales.*

Cuenca, A., Lozano, S., Branca, M. V., Cleve, A., & Fasciolo, M. (2017). Actores significativos que Intervinieron en la Inundación del 2 de Abril: Análisis de los relatos; reclamos; acciones y práctica colectivas. In A. Ronco & I. López (Eds.), *Las inundaciones en La Plata, Berisso y Ensenada: análisis de riesgos y estrategias de intervención*. Universidad Nacional de La Plata.

Cutter, S. L. (2016). Resilience to what? Resilience for whom? *The Geographical Journal, 182*(2), 110–113. https://doi.org/10.1111/geoj.12174

Del Río, J. P., & González, P. (2018). Los asentamientos populares informales en el Gran La Plata: Una geografía cambiante con más de tres décadas de persistencia. In M. C. Cravino (Ed.), *La ciudad renegada: Aproximaciones al estudio de asentamientos populares en nueve ciudades argentinas.* Universidad Nacional de General Sarmiento.

Dieperink, C., Hegger, D. L. T., Bakker, M. H. N., Kundzewicz, Z. W., Green, C., & Driessen, P. P. J. (2016). Recurrent governance challenges in the implementation and alignment of flood risk management strategies: A review. *Water Resources Management, 30*(13), 4467–4481. https://doi.org/10.1007/s11269-016-1491-7

Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. *Global Environmental Change-Human and Policy Dimensions, 16*(3), 253–267. https://doi.org/10.1016/j.gloenvcha.2006.04.002

Froese, R., & Schilling, J. (2019). The nexus of climate change, land use, and conflicts. *Current Climate Change Reports, 5*(1), 24–35. https://doi.org/10.1007/s40641-019-00122-1

Fucks, E. E., D'Amico, G. M., Pisano, M. F., & Nuccetelli, G. (2017). Evolución geomorfológica de la región del Gran La Plata y su relación con eventos catastróficos. *Revista de la Asociación Geológica Argentina, 74*(2), 141–154.

Gigerenzer, G. (2020). What is bounded rationality? In *Routledge handbook of bounded rationality* (pp. 55–69). Routledge.

Grugel, J., & Riggirozzi, M. P. (2007). The return of the state in Argentina. *International Affairs [H.W. Wilson - SSA], 83*(1), 87.

Gulick, L., & Urwick, L. (1937). *Notes on the theory of organization*. Columbia University, Institute of Public Administration.

Hajer, M., & Versteeg, W. (2005). A decade of discourse analysis of environmental politics: Achievements, challenges, perspectives. *Journal of Environmental Policy & Planning, 7*(3), 175–184. https://doi.org/10.1080/15239080500339646

Hannibal, B., Meerow, S., Woodruff, S. C., Roy, M., Gilbertson, P. G., & Matos, M. (2022). Who collaborates on urban resilience? An analysis of flood resilience planning networks in four coastal cities. *Journal of Urban Affairs*, 1–18. https://doi.org/10.1080/07352166.2022.2137033

Hegger, D. L. T., Driessen, P. P. J., Wiering, M., van Rijswick, H. F. M. W., Kundzewicz, Z. W., Matczak, P., Crabbé, A., Raadgever, G. T., Bakker, M. H., Priest, S. J., & Larrue, C. (2016). Toward more flood resilience: Is a diversification of flood risk management strategies the way forward? *Ecology and Society, 21*(4). http://www.jstor.org/stable/26270030

Herzer, H., & Clichevsky, N. (2000). Floods in Buenos Aires: Learning from the past. *Managing Disaster Risk in Emerging Economies*, 32–45.

Hood, C. (2011). *The blame game: Spin, bureaucracy, and self-preservation in government*. Princeton University Press.

Hood, C., Rothstein, H., & Baldwin, R. (2001). Regime development under pressure: Staged retreats and lateral mutations. In C. Hood, H. Rothstein, & R. Baldwin (Eds.), *The government of risk: Understanding risk regulation regimes* (pp. 147–170). Oxford University Press. https://doi.org/10.1093/0199243638.003.0009

Hurtado, A. M., & Cabral, M. G. (2008). Degradación ambiental en el partido de La Plata. *Museo, 22*, 69–77. http://sedici.unlp.edu.ar/handle/10915/47282

Hurtado, M. A., & Giménez, J. E. (2006). *Análisis ambiental del partido de La Plata - Aportes al Ordenamiento Territorial*. Instituto de Geomorfología y Suelos Centro de Investigaciones de Suelos y Aguas de Uso Agropecuario (CISAUA).

Jha, A. K., Bloch, R., & Lamond, J. (2012). *Cities and flooding: A guide to integrated urban flood risk management for the 21st century*. World Bank Publications.

Jong, P., & van den Brink, M. (2017). Between tradition and innovation: Developing flood risk management plans in The Netherlands. *Journal of Flood Risk Management, 10*(2), 155–163. https://doi.org/10.1111/jfr3.12070

Karol, J. L., & San Juan, G. A. (2018). *Saber qué hacer: Construcción de un sistema para la gestión integrada del riesgo hídrico en la región del Gran La Plata*. Universidad de La Plata, Facultad de Arquitectura y Urbanismo.

Kempenaar, A., Laeni, N., van den Brink, M., Busscher, T., & Ovink, H. (2022). 'Water as leverage': Design-led planning for urban climate resilience. *Planning Practice & Research, 39*(1), 72–92. https://doi.org/10.1080/02697459.2022.2104322

Kofman, G., & Bejar, V. G. (2014). *Territorio urbano y desigualdad en tiempos de desastres medioambientales: El caso de las inundaciones en abril de 2013 Paper presented at the Pre-ALAS 2014*. National University of Austral Patagonia.

Kruse, E. E., Pousa, J. L., & Guaraglia, D. O. (2015). Causes and impacts of floods in the northeast of the province of Buenos Aires, Argentina. In M. R. Motsholapheko & D. L. Kgathi (Eds.), *Risk factors, environmental impacts and management strategies*. Nova Science Publishers.

Levy, J., & Goertz, G. (2007). *Explaining war and peace: Case studies and necessary condition counterfactuals*. Routledge.

Liefferink, D., Wiering, M., Crabbé, A., & Hegger, D. (2018). Explaining stability and change. Comparing flood risk governance in Belgium, France, The Netherlands, and Poland. *Journal of Flood Risk Management, 11*(3), 281–290. https://doi.org/10.1111/jfr3.12325

Linnemayr, S., O'Hanlon, C., Uscher-Pines, L., Van Abel, K., & Nelson, C. (2016). Using insights from behavioral economics to strengthen disaster preparedness and response. *Disaster Medicine and Public Health Preparedness, 10*(5), 768–774. https://doi.org/10.1017/dmp.2016.29

Liscia, S. O., Carner, J. L., Amarilla, R., Bacchiega, D., Brea, D., Cielli, P., Dias, R., Lopardo, C., Mariño, M., Spalleti, P., Zárate, F., Angheben, E., Bianchi, G., Borrelli, F., Cecotti, R., Cipponeri, M., Lucino, C., Romanazzi, P., & Tavecchio, H. (2013). *Estudio sobre la inundación ocurrida los días 2 y 3 de abril de 2013 en las ciudades de La Plata, Berisso y Ensenada*. Universidad Nacional de La Plata, Facultad de Ingenieria/Departamento de Hidráulica.

Losano, G. (2011). Código de ordenamiento urbano y economía urbana. Análisis de una problemática concreta en la ciudad de La Plata. *Quid 16. Revista del Área de Estudios Urbanos, 1*, 74–91.

Mayntz, R., & Scharpf, F. W. (1995). Der Ansatz des akteurzentrierten Institutionalismus. In R. Mayntz, F. W. Scharpf, & Max-Planck-Institut für Gesellschaftsforschung (Eds.), *Gesellschaftliche Selbstregelung und politische Steuerung* (pp. 39–72). Campus Verlag.

Morosi, P., & Romanazzi, P. (2018). *Genealogía de una tragedia - Inundación de La Plata, 2 de abril de 2013*. Marea Editorial.

Negri, S., & Zagalsky, R. (2005). *Las Inundaciones de Santa Fe de 2003, el Sistema Federal de Emergencias y la Actuación de los Organismos Nacionales*. Asociación de Administradores Gubernamentales.

Penning-Rowsell, E. C. (1996). Flood-hazard response in Argentina. *Geographical Review*, 72–90.

Pierson, P. (2000). Increasing returns, path dependence, and the study of politics. *The American Political Science Review, 94*(2), 251–267. https://doi.org/10.2307/2586011

Ran, J., & Nedovic-Budic, Z. (2017). Integrating flood risk management and spatial planning: Legislation, policy, and development practice. *Journal of Urban Planning and Development, 143*(3), 05017002. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000376

Rentschler, J., Avner, P., Marconcini, M., Su, R., Strano, E., Vousdoukas, M., & Hallegatte, S. (2023). Global evidence of rapid urban growth in flood zones since 1985. *Nature, 622*(7981), 87–92. https://doi.org/10.1038/s41586-023-06468-9

Resa, S., & Bozzano, H. R. (2014). *Procesos de intervención y transformación con inteligencia territorial.* Paper presented at the XI Simposio de la Asociación Internacional de Planificación Urbana y Ambiente (UPE 11).

Rojas, O., Mardones, M., Rojas, C., Martínez, C., & Flores, L. (2017). Urban growth and flood disasters in the coastal river basin of south-Central Chile (1943–2011). *Sustainability, 9*(2), 195.

Romanazzi, P. G. (2014). *Aproximación a la estimación estadística de la Precipitación Máxima Probable (PMP) para La Plata, Provincia de Buenos Aires, Argentina*. Paper presented at the II Congreso Internacional de Hidrología de Llanuras, Santa Fe.

Romanazzi, P. G., San Juan, G. A., Karol, J. L., Cirio, G., López, I., Tortorelli, M. d. C., Pessolano, B., Bozzano, H., Mariñelarena, A. J., Ruiz de Galaretta, V. A. (2012). *Evaluación de la infraestructura social básica en el marco de la regionalización de la provincia de Buenos Aires.* Convenio de Asistencia Técnica Ministerio de Jefatura de Gabinete de Ministros de la Provincia de Buenos Aires y Universidad Nacional de La Plata.

Romanazzi, P. G., & Urbiztondo, A. J. (2007). *Estudios hidrológicos-hidráulicos-ambientales en la cuenca del Arroyo del Gato*. Laboratorio de Hidrología—ADH—Fi, Universidad Nacional de La Plata.

Rotger, D. V. (2018). Mitigación del riesgo de inundación a partir de la planificación del paisaje. Caso: Arroyo del Gato. Gran la Plata (Buenos Aires, Argentina). *Urbano, 21*(37), 44–53. https://doi.org/10.22320/07183607.2018.21.37.04

Rubinato, M., Shucksmith, J., & Saul, A. WWW-YES-2013. (2013, June 3). Interaction of above/below urban grounds: An experimental facility developed to analyse computer modelling results. In *13th edition of the World Wide Workshop for Young Environmental Scientists (WWW-YES-2013) - Urban waters: resource or risks?*. HAL-ENPC 03. https://hal-enpc.archives-ouvertes.fr/hal-00843116

Schanze, J. 67. (2006). *'Flood risk management - A basic framework' flood risk management: Hazards, vulnerability and mitigation measures* (pp. 1–20). Springer.

Seibel, W., Klamann, K., & Treis, H. (2017). *Verwaltungsdesaster: Von der Loveparade bis zu den NSU-Ermittlungen*. Campus Verlag.

Selznick, P. (1949). *TVA and the grass roots: A study in the sociology of formal organization* (Vol. 3). University of California Press.

Simon, H. A. (1997). *Models of bounded rationality: Empirically grounded economic reason*. MIT Press.

Slavíková, L., Raška, P., & Kopáček, M. (2019). Mayors and "their" land: Revealing approaches to flood risk management in small municipalities. *Journal of Flood Risk Management, 12*(3), e12474. https://doi.org/10.1111/jfr3.12474

Taleb, N. N. (2007). *The black swan: The impact of the highly improbable*. Random House.

Therrien, M.-C., Usher, S., & Matyas, D. (2020). Enabling strategies and impeding factors to urban resilience implementation: A scoping review. *Journal of Contingencies and Crisis Management, 28*(1), 83–102. https://doi.org/10.1111/1468-5973.12283

Thomas, K., Hardy, R. D., Lazrus, H., Mendez, M., Orlove, B., Rivera-Collazo, I., Roberts, J. T., Rockman, M., Warner, B. P., & Winthrop, R. (2019). Explaining differential vulnerability to climate change: A social science review. *Wiley Interdisciplinary Reviews: Climate Change, 10*(2), e565.

van den Ende, M. A., Hegger, D. L. T., Mees, H. L. P., & Driessen, P. P. J. (2023). Wicked problems and creeping crises: A framework for analyzing governance challenges to addressing environmental land-use problems. *Environmental Science & Policy, 141*, 168–177. https://doi.org/10.1016/j.envsci.2023.01.006

van Herk, S., Zevenbergen, C., Ashley, R., & Rijke, J. (2011a). Learning and action alliances for the integration of flood risk management into urban planning: A new framework from empirical evidence from The Netherlands. *Environmental Science & Policy, 14*(5), 543–554. https://doi.org/10.1016/j.envsci.2011.04.006

van Herk, S., Zevenbergen, C., Rijke, J., & Ashley, R. (2011b). Collaborative research to support transition towards integrating flood risk management in urban development. *Journal of Flood Risk Management, 4*(4), 306–317. https://doi.org/10.1111/j.1753-318X.2011.01113.x

Vértiz, F. (2016). *La intervención estatal en la producción de la ciudad. Conformación y orientación de la política urbana en el partido de La Plata (2003–2014)*. Universidad de La Plata.

Vértiz, F. (2019). Actores, ámbitos y estrategias detrás de la regulación urbana en La Plata (Argentina) (Legislación urbana; Regulación de los usos del suelo; Efectos sociales del derecho) / Actors, areas and strategies involved in the urban regulation in La Plata (Argentina) (Urban legislation; Land use regulation; Social effects of law). *Revista Direito e Práxis*. https://doi.org/10.1590/2179-8966/2019/37797.

Wiering, M., Liefferink, D., & Crabbé, A. (2018). Stability and change in flood risk governance: On path dependencies and change agents. *Journal of Flood Risk Management, 11*(3), 230–238. https://doi.org/10.1111/jfr3.12295

Zahariadis, N. (2016). Bounded rationality and garbage can models of policy-making. In B. G. Peters & P. Zittoun (Eds.), *Contemporary approaches to public policy* (pp. 155–174). Palgrave Macmillan. https://doi.org/10.1057/978-1-137-50494-4_9

Media Sources

Barrera, L., Demaestri, V., & Mac Kenzie, J. L. (2008, May 5). A la deriva. *La Pulseada*.

Bruera volvió a usar Twitter y pidió ayuda para 'poner de pie a La Plata.' (2017, November 17). Infobae.

del Cueto, M. S. (2013, December 8). ≃De qué hablamos cuando hablamos de Código de Ordenamiento Urbano?. *Infoblancosobrenegro*.

El agua tapó todo. (2002, 28 May). El Día.

Inundaciones de La Plata: Un único condenado que deberá pagar $mil. (2019, March 7). Perfil.com.

López, M. D., & Sager, F. (2010, June). La ciudad desregulada. *La Pulseada*.

Pagni, C. (2013, April 5). El resultado de una catástrofe política. *La Nación*.

Revisa la Ciudad el código de ordenamiento urbano. (2009, May 31). El Día.

Rusconi, J. (2019). Pedimos que se cambie el código de ordenamiento urbano. *Radio Realpolitik*. Retrieved March 7, 2024, from https://www.youtube.com/watch?v=TwD_KEfClGE&feature=share

Public Documents

Autoriad del Agua (AdA), Organismo Provincial para el Desarollo Sostenible (OPDS) & Dirección Provincial de Hidráulica (DiPSOH) (2012). Síntesis del proceso preparatorio para la elaboración de un Plan de Gestión Integral de la Cuenca del Arroyo del Gato. *La Plata*.

Carusso, L. (2007). *Plan hidráulico de la ciudad de la plata*. Paper presented at the IV Jornadas de Saneamiento Pluvial Urbano 2007 Rosario.

Concejo Deliberante La Plata. (2010). *Década de 1980*. Historia del Concejo Deliberante. Retrieved October 5, 2019, from http://www.concejodeliberante.laplata.gov.ar/Textos/historia3.html

CPCN. (2009). *Nota enviada al Sr. Intendente de la Municipalidad de La Plata Dr. Pablo Bruera*. https://cpcnpba.org.ar/wp-content/uploads/file/archivos/nota-desactivacion-cout.pdf

Foster, S., & Garduño, H. (2002). Argentina: Mitigation of groundwater drainage problems in the Buenos Aires conurbation: Technical & institutional way forward. *Sustainable Groundwater Management, Lessons from Practice, Case Profile Collection* (4).

Giménez, J. C., Bergman, L. A., Devoto, G., & Picasso, J. (2003). *Manual para el diseño de planes maestros para la mejora de la infraestructura y la gestión del drenaje urbano*. Presidencia de la Nación, Secretaría de Obras Públicas, Unidad Coordinadora de Programas con Financiación Externa.

Gobernador de La Provincia de Buenos Aires B20080000486. (2008). Declaración de Emergencia Hídirica. *Decreto 486/2008*.

International Federation of Red Cross and Red Crescent Societies. (2004). *Final report - Argentina: Floods in Santa Fe Province*. https://reliefweb.int/report/argentina/argentina-floods-santa-fe-province-appeal-no-1003-final-report

Lee, H., Calvin, K., Dasgupta, D., Krinmer, G., Mukherji, A., Thorne, P., Trisos, C., Romero, J., Aldunce, P., & Barret, K. (2023). *Synthesis report of the IPCC Sixth Assessment Report (AR6)*, Longer report. IPCC.

Suprema Corte de Justicia de la Provincia de Buenos Aires. (2011). Fundacion Biosfera y Otros C/ Municipalidad De La Plata S/ Inconst. Ord. No 10.703 I-71446. *La Plata*.

UN-Water. (2019, April 4). Climate change and water. *UN-Water Policy Briefs*. "Urbanización irresponsable", una causa del desastre y las muertes en La Plata. *La Nación*.

World Meteorological Organization (WMO). (2012). *Urban flood management in a changing climate*. Integrated Flood Management Tools Series [APFM Technical Document].

CHAPTER 6

Missing the Window: Barriers to Building Back Better in the Western Cape, South Africa

Robyn Pharoah

6.1 Introduction

The Western Cape experiences frequent disasters. These include disasters triggered by wildfires, floods, droughts and animal disease outbreaks, as well as recurrent 'everyday' disasters linked to poverty and underdevelopment, such as informal settlement fires, traffic accidents and poor environmental health. Between 2003 and 2014, for example, the province experienced 12 declared flood disasters, almost one event per year for the period (Pharoah et al., 2016), with some local municipalities experiencing as many as 8 consecutive floods, some multiple events in the same year. The province also experienced a severe drought between 2009 and 2011, and another between 2016 and 2019, where Cape Town—the province's largest city—faced the prospect of 'Day Zero' when the taps would run dry. Some parts of the province, such as Beaufort West in the inland Central Karoo, have lived with an ongoing severe drought for several years

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and many towns throughout the province live with permanent water restrictions. Climate modelling suggests that these kinds of severe weather events will become even more frequent and intense as the world's climate continues to change (Davis-Reddy & Vincent, 2017), and without substantial progress in risk reduction, the province (and South Africa as a whole) will see increasing numbers of disasters.

'Building back better' (BBB) following disasters provides an invaluable window of opportunity to prioritise, fund and implement measures to reduce the risk of future disasters. BBB has become a central tenet of disaster risk reduction globally. This is encapsulated in Priority Four of the Sendai Framework for Disaster Risk Reduction, the United Nations framework guiding disaster risk reduction (DRR) globally (United Nations, 2016), which identifies post-disaster recovery as a critical opportunity for achieving more resilient nations and communities, that are better able to prevent and withstand disasters. South Africa's disaster risk management legislation also highlights recovery and rehabilitation as critical spaces for developing and applying disaster risk reduction measures. Despite policy commitment to building back better, however, seizing these opportunities has proved challenging in practice.

Drawing on two case studies from South Africa's Western Cape province, this chapter examines the obstacles to building back better in South Africa. It shows how institutional arrangements and legislation shaping the allocation, release and oversight of government funds for recovery and rehabilitation following disasters hamper risk reduction, not only preventing mitigative actions but critically also creating and deepening disaster risk—even where there is political will and capacity for promoting resilience. The chapter begins with a brief overview of the some of the challenges associated with BBB internationally. It then discusses South Africa's regulatory framework with respect to DRR, and the processes and funding mechanisms available to fund recovery and rehabilitation activities following disasters. It goes on to describe the methodology used to collect the data used in the case studies, the key features of the two disaster events and the illustrative examples. Finally, it draws out the lessons learned.

6.2 The Concept of Building Back Better

The idea of BBB has become central to the conceptualisation of recovery following disasters. The term rose to prominence in December 2006, when it was used by the United Nations Secretary-General's Special

Envoy for Tsunami Recovery, former US President Bill Clinton, in a report issued on the anniversary of the 2004 Indian Ocean Tsunami. This recognised that disasters can create opportunities to shift development patterns that perpetuate disaster risk—and that recovery can perpetuate pre-existing patterns of vulnerability and disadvantage (Clinton, 2006). Disasters have even been characterised as a 'helpful interruption' that can be used to challenge inadequate policies and practices (Fernandez & Ahmed, 2019, p. 1). This is reflected in the Sendai Framework, with Priority Four calling on governments and other role-players to BBB in recovery, rehabilitation and reconstruction (United Nations Office on Disaster Risk Reduction, 2015).

The term was initially conceptualised in terms of land use, spatial planning and construction standards, but the concept has expanded to represent a broader opportunity for building greater resilience into recovery (Cheek & Chmutina, 2022). The United Nations (2016) defines BBB as the use of the recovery, rehabilitation and reconstruction phases after a disaster to increase resilience by integrating DRR measures into the restoration of physical infrastructure, societal systems, livelihoods, economies and the environment. The Global Facility for Disaster Reduction and Recovery (GFDRR) unpacks this, arguing that it is an approach to post-disaster recovery that reduces vulnerability to future disasters and builds community resilience to address physical, social, environmental and economic vulnerabilities and shocks. The GFDRR maintains that BBB applies to all aspects and sectors of post-disaster work, and not only from the immediate hazard but also threatening hazards and conditions (GFDRR, 2015). Ideally, BBB should include both structural and non-structural measures in reconstruction programmes[1] (Fernandez & Ahmed, 2019). Being better prepared may also require policy reforms, strengthening existing institutions and adequate building laws, regulations and codes (Islamabad & Haris, 2019).

Despite the 'obvious rightness of the proposition' (Fan, 2013), some criticise the concept (see Benge and Neef (2020) for a comprehensive overview). Cheek and Chmutina (2022), for instance, argue that BBB is

[1] Structural mitigation refers to usually engineering measures to reduce risk, such as building dams, canals or stormwater channels. Non-structural mitigation involves environmental, behavioural and institutional actions, such as preventing settlement in high-risk areas or protecting or rehabilitating natural resources such as wetlands or mangrove forests that can reduce, in this case, flooding or coastal hazards.

ideologically rooted in neoliberal values, and often fails to address the needs of the marginalised or actively change social and political systems that create risk (Cheek & Chmutina, 2022). Collodi and his colleagues (Collodi et al., 2021) make a similar point, arguing that the concept is not value-free and that recovery efforts are political processes with winners and losers, while Benge and Neef (2020) argue (amongst other critiques) that the recovery process can be easily co-opted by dominant development ideologies. There is also the question of what 'better' looks like and who decides what 'better' actually means (Fan, 2013; Fernandez & Ahmed, 2019; Cheek & Chmutina, 2022), with 'building back safer', 'building back smarter' and 'building back greener' proposed as alternatives that provide a clearer goal for post-disaster reconstruction (Fernandez & Ahmed, 2019). Wisner (2017, p. 104) argues the tendency to conceptualise BBB in relation to specific disasters is also problematic, and that events are linked temporally and embedded in ongoing everyday risk accumulation processes. Thus, reducing risk for 'the next time' cannot adopt a piecemeal approach and needs to address processes of risk accumulation and the root causes of social vulnerability to loss, injury and death.

Literature also highlights a range of barriers to implementing BBB approaches, and that although BBB is a desirable goal, projects have often failed to meet expectations (Fan, 2013; Kim & Olshansky, 2015; Fernandez & Ahmed, 2019). Most relevant to this chapter, the inertia of institutions responding to disasters often creates challenges (Islamabad & Haris, 2019). The post-disaster environment is complex, challenging and dynamic (Rouhanizadeh et al., 2020); involves many different role-players and stakeholders; and requires rapid marshalling of resources. High pressure post-disaster environments also require flexibility (Mannakkara & Wilkinson, 2016) and, ideally, shortened procurement times that reduce the lead-time needed for beginning work (Macaskill & Guthrie, 2018). However, bureaucracies charged with rebuilding tend to move slowly and in complicated ways (Kim & Olshansky, 2015) and legislative processes can slow the release of funding, and delay recovery (Rouhanizadeh et al., 2020). Many countries also lack budgets for recovery (Mannakkara & Wilkinson, 2016; Macaskill & Guthrie, 2018; Fernandez & Ahmed, 2019; Rouhanizadeh et al., 2020). Other institutional barriers include weak bureaucratic structures, conflicting recovery objectives, corruption, poor planning and inadequate institutional coordination (Islamabad & Haris, 2019).

Although South Africa's government has committed itself to BBB following disasters and has created financial tools to achieve this, as internationally, BBB has proved difficult in practice. This is primarily due to legislative gaps and cumbersome regulatory processes that hamper both risk reduction and recovery. The remainder of this chapter explores these challenges.

6.3 South Africa's Regulatory Framework

South Africa has comprehensive legislation to guide risk reduction and management (Pelling & Holloway, 2006; van Niekerk, 2014; van Niekerk et al., 2020). Like many other countries, South Africa adopted a response-oriented approach historically that focused on emergency preparedness and response and provided humanitarian assistance to those affected by disasters. However, the Disaster Management Act (DMA) and the accompanying National Disaster Management Framework (NDMF), promulgated in 2002 and 2005, respectively, promote a holistic response that aims to both reduce the likelihood of disasters and manage better those that do occur. This approach continues, without substantive changes, in the recent Disaster Management Amendment Act of 2015. The DMA and NDMF, which guides the implementation of the act, predate the widespread use of the BBB concept. However, Key Performance Area Four calls for an integrated and coordinated policy that focuses on rapid and effective responses to disasters and post-disaster recovery (National Disaster Management Centre (NDMC) (2005). It notes that recovery from high-profile disasters provides opportunities to promote risk reduction, owing to the heightened awareness of disaster risk, risk drivers and their impact.

When they were promulgated, the DMA and NDMF were widely regarded as progressive examples of best practice globally (Pelling & Holloway, 2006; van Niekerk, 2014; van Niekerk et al., 2020), but operationalisation of the legislation has proved challenging (IFRC, 2011; Financial and Fiscal Commission, 2012; van Niekerk, 2014; Madubula & Van Niekerk, 2015; van Niekerk et al., 2020). Core problems include inadequate financial and human resources, incomplete establishment of the required institutional infrastructure, particularly at the local government (municipal) level (van Riet, 2009; van Niekerk, 2014; van Niekerk et al., 2020) and poor mainstreaming of risk reduction across sector departments and all levels of government (van Riet, 2009; International

Federation of the Red Cross and Red Crescent (IFRC), 2011; Financial and Fiscal Commission, 2012; Pharoah et al., 2014; van Niekerk, 2014; Madubula & Van Niekerk, 2015). These problems are driven and worsened by the location of the disaster risk management function within the government's institutional hierarchy. The DMA and NDMF envisage disaster management as a coordinating function, responsible for promoting and guiding activities by other government departments, but current institutional arrangements prevent this. Instead of being located in the highest political structures, such as the Office of the Presidency, provincial Premier or Mayor, where they would have the authority to promote and harness action across institutions, disaster management centres and personnel are embedded within departments at the national and provincial level, and line-functions in local governments, where they have limited visibility and influence (IFRC, 2011; Pharoah et al., 2014; van Niekerk, 2014; Madubula & Van Niekerk, 2015).

Prevailing funding arrangements also hamper risk reduction, and most relevant to this chapter, BBB following disasters. While the DMA and NDMF establish an institutional framework, they provide little guidance on funding responsibilities (Madubula & Van Niekerk, 2015). This failure to articulate clearly how disaster risk management should be paid for frequently compromises planning and prevention, as provincial and municipal governments view disaster management as an 'unfunded mandate' and do not allocate resources for risk reduction and prevention in their budgeting processes (Financial and Fiscal Commission, 2012; Madubula & Van Niekerk, 2015)—although this is also partly due to line functions' failure to understand that much of what they already do constitutes risk reduction. The funding mechanisms that are available tend to be response-oriented (Financial and Fiscal Commission, 2012; Madubula & Van Niekerk, 2015), but as discussed in this chapter provide very little space for risk reduction, innovation and adaptation.

6.4 Funding Post-disaster Recovery and Rehabilitation in South Africa

There are three primary mechanisms for funding response and recovery and rehabilitation following disasters in South Africa. The first is reallocating funding from operating or capital budgets of sector departments and other institutions. Declaring a state of disaster makes available two

additional tools. At the provincial level, these are the Provincial Disaster Response Grant (PDRG) and the Disaster Recovery Grant (PRG). These are replicated at the municipal level (the MRG and MRG, respectively). These disaster grants are supposed to provide an injection of funds to pay for, for instance, emergency repairs to essential infrastructure, humanitarian response and provision of essential services. Sector departments and other organs of state are responsible for longer-term rehabilitation and reconstruction, primarily through reallocation of existing budgets, but where costs exceed their available resources, they can mobilise funding through the disaster recovery grants (NDMC, 2017).

In addition to enacting regulations to manage events, declaring a disaster enables access to the response and recovery grants. Once a disaster is declared, affected municipal, provincial and national departments undertake initial damage assessments, which are collated and verified by the relevant provincial disaster management centre, and submitted to the National Disaster Management Centre (NDMC) (Fig. 6.1). The provincial disaster management centre also requests the NDMC to classify (essentially confirm) the event as a disaster, so that it can be officially gazetted as such. The NDMC then appoints representatives to assess and verify damages. Much like an insurance company would, these representatives undertake site visits to assess and verify the

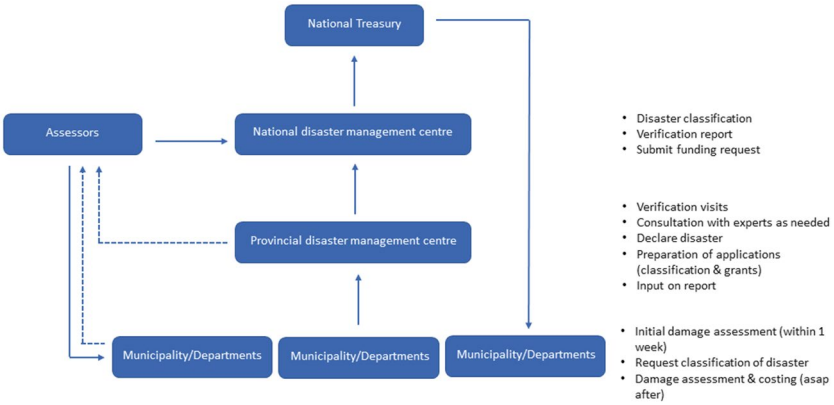

Fig. 6.1 Overview of recovery grant application process, South Africa

losses identified in the funding request, obtain independent cost estimates where appropriate and confirm or amend the awards, whereafter the applications are submitted to the Treasury, who disburses the funding. The provincial disaster management centre and sometimes affected municipalities or departments can review the verified report. However, the damage covered can vary between events and funding is contingent on applicants meeting several criteria. Damage to informal dwellings and agricultural costs stemming from damage to crops and boreholes and soil losses are usually not eligible for funding. To be considered for funding:

- Damage to infrastructure must be specific to the area gazetted in the disaster declaration
- Infrastructure cannot be insured, and cannot include projects that access funding from any other streams, such as municipalities' operating budget or capital infrastructure grants
- Damage must be unforeseen and unavoidable, and cannot be associated with inadequate maintenance or neglect
- Funding cannot have been provided previously to repair the same infrastructure

Critically, applications must disclose whether infrastructure has been repaired already, along with the value of repairs, and where the funding was obtained. Institutions are not usually reimbursed for undertaking even temporary repairs. Altogether, this can be a lengthy process. This is due to the time-consuming verification procedures, but also because it synchronises with the government's budget adjustment processes that begin mid-way through the financial year, which runs between March and April the following year. Moreover, while the exclusion criteria are sensible from a financial accountability perspective, in practice they serve to undermine opportunities to BBB.

The two case studies that follow illustrate some of these core challenges with respect to operationalising South Africa's commitment to BBB. The first focuses on post-disaster recovery efforts following large wildfires in 2017, while the second draws on post-event analysis of five severe weather events in the Western Cape between 2011 and 2014.

6.5 Exemplary Cases

Methodologically, both case studies presented below are drawn from post-event analyses of the events (Pharoah et al., 2016, 2017; Forsyth et al., 2019), and partner studies (Walls et al., 2019), and build on a longer longitudinal record of post-event research in the province (see Holloway et al., 2010). The purpose of the research was to document each event end-to-end, including the risk drivers and accumulation processes underlying the disaster; the event itself, including the response by various role-players; recovery and rehabilitation efforts; the extent to which lessons were learned; and whether there is evidence of BBB. The approach in all cases followed a similar methodology. This included:

- the collection and review of situation reports provided by disaster management and other responders;
- a desktop review of relevant literature, reports and media coverage to identify issues and areas of specific interest to be explored;
- collection and analysis of hydro-meteorological data where relevant;
- in-depth interviews with governmental, non-governmental organisations, members of the public and any other role-players identified in the situation reports, desktop reviews and by other participants;
- visits to sites and areas impacted; and,
- the collection of data on the economic costs sustained, primarily by government, but also private and parastatal organisations where this data is accessible.

The Knysna Fires of 2017

On 7 June 2017, wildfires swept through the Garden Route District Municipality along the Western Cape's southern coast. The towns of Knysna, Sedgefield and Plettenberg Bay bore the brunt of the fires (Illustration 6.1). The so-called Knysna Fires burned approximately 19,300 hectares, including several forestry plantations, and mopping up operations continued for several weeks. Geographically, there have been larger wildfires in South Africa, and the fire was small compared to many international examples, but they were the most destructive on record for South Africa. Seven people were killed, over 900 dwellings were destroyed and thousands of firefighters were deployed from across the country. The cost to government departments and the forestry and insurance industry

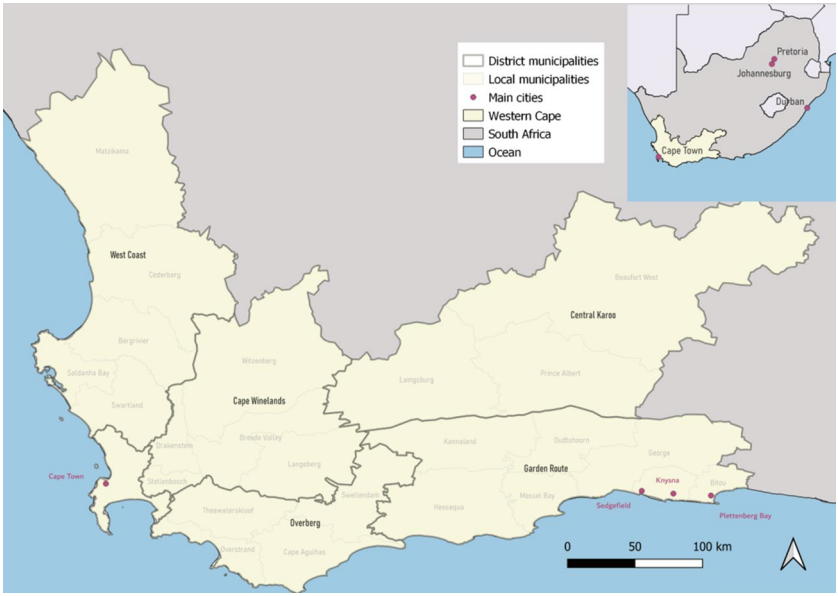

Illustration 6.1 Map of the Western Cape, South Africa, showing case study sites

alone amounted just over ZAR 3 billion (approximately US $1.7 million), while the social and economic impacts endured for years after the event (Forsyth et al., 2019).

Various risk drivers came together to create the ideal conditions for the ignition and spread of the fires. Gale-force winds fuelled and propelled the fires and made firefighting difficult. An ongoing drought in the Garden Route and elsewhere in the Western Cape resulted in very dry conditions, and water shortages hindered efforts to fight the fire (Kraaij et al., 2018; Forsyth et al., 2019). This was compounded by unseasonably high temperatures, very high fuel loads and the expansion of the urban footprint into high-risk areas, as well as legislative and institutional issues hampering risk reduction and capacity constraints with respect to both prevention and response (Kraaij et al., 2018; Forsyth et al., 2019). This constellation of hydro-meteorological, bio-physical, institutional and human factors came together to create a fire of rare ferocity and magnitude, but at least three studies had foreseen damaging wildfires in the area, owing to inadequate fire-risk management and fuel management, in particular (Kraaij et al., 2018).

High fuel loads were a critical ingredient in creating the disaster. The proliferation of alien invasive vegetation, such as pine trees and various species from Australia, is a major source of fire-risk in the Western Cape. The Western Cape's indigenous vegetation, fynbos, is fire-adapted and needs to burn periodically to remain healthy. However, commercial plantations, mostly eucalyptus and pines, and naturally invaded land generate more biomass than indigenous fynbos, resulting in more intense and severe fires. Invading trees are also much taller than the generally shrubby fynbos, making fires more difficult to fight and control (Forsyth et al., 2019; Wilgen et al., 2020). In Knysna, analysis of landcover imagery showed that approximately 33% of the area burnt was indigenous or lightly invaded vegetation, 35% was under commercial forest plantations, while 17% was heavily invaded by alien plant species. Both alien vegetation and settlements tended to be concentrated in the same areas, and the research showed that approximately 94% of the structures burned were within 90 metres of high or extreme fuel loads, mostly generated by alien vegetation (Forsyth et al., 2019). This was attributed largely to poor land management by public and private landowners, particularly insufficient control of invasive alien vegetation or allowing moribund brush to develop in indigenous fynbos.

Clearing Alien Vegetation Following the Fires

Recovery efforts following the fires were centred on the Garden Route Reconstruction Initiative (GRRI). The initiative was started by the Premiere of the Western Cape in July 2017, with leadership provided by the Western Cape's Department of Economic Development and Tourism. It aimed to create a multi-disciplinary, intergovernmental and multisectoral platform to align and maximise recovery and rehabilitation efforts. It brought together national, provincial and local governments, state-owned enterprises, community members, civil society organisations and the private sector in seven sector-based working groups to design and implement recovery projects (Pharoah et al., 2019). The Western Cape Government envisaged their role as providing short-term leadership and support, with projects ultimately to be handed over to municipalities to implement. The GRRI represented an example of intergovernmental cooperation and brought together public and private stakeholders that would not have usually engaged with one another, and the leadership was widely praised. Implementation, however, was frustrated by a range of obstacles. These included inadequate engagement with municipal partners in the design of

the initiative, despite them being expected to implement projects; placing additional demands on already overburdened and stressed officials; and poor synchronisation with municipal processes and procedures. However, the greatest barrier to BBB was obtaining funding for recovery efforts, along with slow disbursement of allocated funds (Pharoah et al., 2017).

This was prominently illustrated in the Environmental Management Workstream. Environmentalists from local government and conservation organisations, as well as disaster management authorities, realised early on that there was a pressing need to stabilise slopes denuded by the fires to prevent landslides and erosion. They also prioritised removing alien vegetation, which germinates following fires and recovers more rapidly than fynbos, not only increasing fuel loads but also suppressing the recovery of biodiversity and natural ecosystems in the invaded areas. Immediately following the fires, Knysna Municipality spent approximately ZAR 700,000 (approximately US $40,975), largely donations from members of the public and businesses, on primarily slope stabilisation activities—although this proved controversial as donors expected the money to be spent on humanitarian assistance and recovery. Concurrently, the Western Cape Provincial Disaster Management Centre (WCPDMC), representatives from local businesses and the GRRI's Steering Committee worked together to develop a comprehensive ZAR 37 million (US $2.1 million) funding proposal for NDMC to finance ambitious programmes to remove alien vegetation and rehabilitate land cleared. The National Treasury ultimately committed ZAR 54 million (US $3.1 million) for environmental work by reallocating resources earmarked for drought relief, but only in November 2018—16 months after fires.

The delays in disbursing the funding provided by the Treasury prevented implementation of the envisaged projects. Knysna Municipality independently obtained funding from the Department of Environmental Affairs and Development Planning (DEADP), and by late 2018 had cleared approximately 600 hectares of municipal land, and reseeded 90 hectares to kick-start the regeneration of indigenous vegetation. However, a lack of recovery funding prevented most of the envisaged clearing. This failure to clear alien species following the fires has significantly increased fire-risk in the area. In the post-event research, conducted 2018, most stakeholders believed that the recovery of alien vegetation following the fires had exponentially increased fuel loads in areas affected (and that clearing would be considerably more expensive, as vegetation was better established) (Forsyth et al., 2019). Local action groups have also

Illustration 6.2 Alien vegetation regrowth following the Knysna Fires. (Images courtesy of Riaan Van den Dool)

documented and sounded the alarm about the risk posed by the progressive growth of alien vegetation since 2017 (e.g., Meiring, 2017; GRDM, 2020; Meiring, 2017). Illustration 6.2 shows examples of regrowth of alien vegetation in burned areas. Figure (a) highlights the blackened remains of burned alien vegetation, with abundant regrowth of young alien plants, including slower growing pine trees, while image (b) shows regrowth of faster-growing alien vegetation approximately one year after the fires.

Replication of High-Risk Settlements Patterns

Many of the homes and businesses destroyed by the fire were located within Knysna's wildland urban interface (WUI). The expansion of the urban footprint into fire-dependent ecosystems increased exposure of communities to wildland fires, but features of the settlements themselves increased the losses associated with the fires. Being close to nature is a major drawcard in the Garden Route. Many homeowners want to be 'close to nature', with houses and tourist establishments nestled within and among indigenous vegetation and commercial plantations. This contributed significantly to the spread and impact of the fires. Analysis of the buildings severely damaged or destroyed (Walls et al., 2019) showed that three-quarters (74%) were surrounded by vegetation which provided a pathway for the fire to reach the structure. Only 17% had limited or no vegetation around them and were most probably ignited directly by

embers carried from burning houses or vegetation, while approximately 9% of homes were ignited from adjacent structures or homes.[2]

The findings for building materials were less clearcut. While it might be expected that timber structures and thatched rooves were more flammable, the data showed that buildings constructed from a range of materials were destroyed. Only 23% of the dwellings were built from wood. Similarly, only 4% had thatch rooves, while 3% were constructed of timber. The reason for this is that all buildings have windows, air vents, chimneys, gutters and other weak points through which the contents of homes can be ignited (Forsyth et al., 2019; Walls et al., 2019). Concrete buildings may also have flammable features such as wooden decking—although wood (including structures) treated with fire-retardants is significantly less flammable. Taken together, the findings suggested that while building materials are important, the features of the surrounding environment are critical; the survivability of buildings is strongly influenced by the fuels available in the home ignition zone (HIZ) immediately surrounding the structure (Forsyth et al., 2019).

The importance of the HIZ is illustrated by Illustration 6.3. It shows examples of homes that survived the fire. Images (a) and (b) show a new housing complex still under construction, where there was very little vegetation and materials not typically flammable. Images (c) and (d) show homes where isolated structures survived, largely owing to well-maintained spaces around structures, featuring short grass lawns, limited vegetation, as well as typically non-combustible construction materials (Walls et al., 2019). In all three cases, the fires destroyed the structures on adjacent properties.

[2] This analysis was undertaken by Walls et al. (2019). It is based on analysis of data collected by South African National Parks (SANParks) immediately following the fires that, assisted by volunteers, visited all the structures which were destroyed. Details regarding the homes were recorded, and the status of the damage was categorised as 'Destroyed', 'Damaged' or 'No damage'. The Knysna Fire Brigade assisted in the verification of the data. A total of 1112 geo-located points with data were identified, of which 929 were identified as destroyed or severely damaged. Each of these dwellings was examined using Google Earth imagery to identify the likely cause of ignition, including the presence of flammable vegetation nearby. Dwellings were classed at having been affected by embers (ember attack) where there was no or negligible vegetative or other buildings damage in their immediate vicinity, and structure to structure where adjacent dwellings were burned, at a distance from vegetative fuels. Google Street View was used to analyse each structure to identify dwelling materials.

Illustration 6.3 Examples of dwellings that likely survived the fires owing to lower-fuel HIZs. (Source: Walls et al. (2019). Images courtesy of Vulcan Wildfire Management (2018))

Rebuilding following the fires provided an opportunity to incorporate these lessons, by members of the public, insurance companies and government. Local and national authorities could, for example, conceivably introduce regulations stipulating the use of lower-risk housing materials in high fire-risk areas or by-laws that require owners to keep a minimum space around structures clear of vegetation and other fuels. Instead, homeowners have largely rebuilt as before, and there has been no regulatory change. Illustration 6.4 demonstrates this replication of risk post-fire. Image 6.4a shows a cluster of severely damaged or destroyed dwellings (indicated by the yellow markers[3]) in 2016, 6.4b shows the same area five months after the fires and 6.4c shows the situation in 2022. As the images show, five years on from the fires, the houses and surrounding landscape are largely indistinguishable from that prior to the fires.

[3] Data collected by the South African National Parks (SANParks) immediately following the fires, verified by the Knysna Fire Brigade. The dataset comprises houses severely damaged or destroyed as determined by Walls et al. (see footnote 2).

Illustration 6.4 A case study of destroyed dwellings' location with respect to vegetation before and after the Knysna Fire of 2017

There are several reasons for this lack of change. One is inadequate risk ownership. People often do not understand fire-risk or what they can do to reduce it, but many also continue to hold government and the fire services responsible for reducing risk (Vulcan Wildfire Management, 2018; Forsyth et al., 2019). There are also gaps in the legislative architecture available to support risk reduction. South Africa's National Veld and Forest Fire Act (NVFFA), which underpins fire-risk reduction in rural areas, clearly establishes landowners' responsibility to create and manage firebreaks and encourages membership of Fire Protection Associations (FPAs), which can guide and promote risk-reducing activities. However, the NVFFA applies to land outside of the urban footprint, and it is unclear who is responsible for promoting and facilitating risk reduction activities in fringe areas like the WUI. Fires within urban areas fall under the purview of different legislation, the Brigade Services Act (FBSA), which makes local municipalities responsible for firefighting in urban areas, but this act is response-oriented, providing a weak mandate for risk reduction

(Pharoah et al., 2017; Forsyth et al., 2019).[4] Finally, legislation is difficult to change. An urban planner working for Knysna Municipality noted that although it was relatively easy to enact a by-law, building-related regulations must conform to the National Building Code, and that without changes to national legislation, it would be difficult to introduce restrictive laws at a local level.

Flooding in the Western Cape, 2011–2014

Between 2011 and 2014, the Western Cape experienced five declared flood disasters associated with notorious 'cut-off low' weather systems, which are associated with intense and prolonged rainfall.[5] From 7 to 9 June 2011, heavy rain over the southern part of the Western Cape resulted in heavy rainfall and flooding, particularly in the Garden Route and Cape Winelands District Municipalities (see Illustration 6.1). In July and August 2012, two consecutive high-impact weather systems brought heavy rain and very cold conditions. The first, between 13 and 14 July, and the second, between 7 and 9 August, affected most of the Western Cape, but particularly the Garden Route, Central Karoo and Cape Winelands. Between 15 and 17 November 2013, much of the Western Cape experienced intense rainfall, and strong winds in some areas. The Cape Town Metropolitan Municipality, Overberg and Cape Winelands District Municipalities were most affected, with many weather stations recording record rain levels. Less than one month later, between the 6 and 10 January 2014, a cut-off low weather system, combined with a tropical low-pressure system, again produced heavy rainfall across the Western Cape. Rainfall levels for the January event were amongst the highest

[4] The Municipal Systems Act (2000) guides the internal functioning of municipalities. It stipulates that local municipalities are responsible for all structural fires, motor vehicle accident rescues and open field fires inside the urban edge. District municipalities, on the other hand, are responsible for all open field and bush fires outside the urban edge, mountain fires and incidents of hazardous materials spills.

[5] A cut-off low is a mid-latitude cyclone that becomes 'cut-off', or severed, from the main planetary circulation, and spins off independently. Because it is no longer attached to the parent system, it loses momentum, remaining stationary or moving very slowly before dissipating. They are associated with very strong atmospheric instability and powerful convection and a range of severe weather, including torrential rainfall, snow in mountainous areas and violent winds. They are the main drivers of damaging floods in South Africa (Holloway et al., 2010).

recorded since 1983, with several stations recording cumulative rainfall of more 250 mm (Pharoah et al., 2016).

Impact

The events had wide-ranging impacts. Twelve people lost their lives, while more than 23,000 were evacuated from informal settlements and low-income housing areas, as well as farms and more affluent areas. The flooding in the Garden Route in 2011 left 256 segments of road needing repair, at an average cost of ZAR 583,921 (roughly US $33,967) per segment. Across all the disasters, water and sewerage treatment facilities and pipelines were damaged and services disrupted. Flash-flooding associated with the event in November 2013 forced the rescue and evacuation of 121 patients from a hospital in Somerset West, near Cape Town, the first evacuation of an entire medical facility documented on the continent. The same system affected 18,000 residents in 44 informal settlements within Cape Town (WCDMC, 2013). Altogether, total financial costs to government departments, municipalities and the agricultural sector were estimated at ZAR 1.6 billion (approximately US $93 million). Agricultural costs and losses linked to weather systems were estimated at ZAR 900.5 million, constituting 56.9% of the total costs (Pharoah et al., 2016).

As with the Knysna Fires, the floods reflected several coinciding risk accumulation processes. Key risk drivers included incremental changes associated with urban development and agricultural practices, which increased flood risks by altering catchment conditions. They also included shortcomings in integrated catchment and river management, contributing to the build-up of sediment in riverbeds and around bridges and culverts. Inadequate removal of reeds and alien vegetation, and where clearing projects were undertaken, failure to clear debris from riverbeds and floodplains, were also highlighted as risk drivers. These factors, in turn, reflect institutional barriers to effective river management, particularly legislation requiring lengthy and expensive environmental impact assessments before material such as alien vegetation can be removed from water courses. Residential, commercial and infrastructural expansion and densification in flood-prone areas also increased risk, not only placing homes, facilities and infrastructure in harm's way but also impeding the flow of natural watercourses and overland run-off during heavy rain. In many cases, these dynamics were compounded by ageing and inadequate road and stormwater infrastructure. For instance, much of the Province's road and bridge

network was built in the 1950s, and complies with out-dated design criteria. Much of the province's drainage infrastructure is also old, inadequately maintained or simply not designed to meet prevailing demands (Pharoah et al., 2016).

Restoring Infrastructure Following Flood Events

Efforts to restore damaged infrastructure after these events highlight obstacles to BBB, particularly for municipalities under local pressure to restore essential services. The lengthy verification process resulted in smaller under-resourced local authorities, which do not have or allocate a budget to make interim repairs, being unable to rehabilitate infrastructure. In one town, for instance, permanent repairs to water supply infrastructure damaged in January 2014 remained outstanding in September 2014, when the research was conducted, with reported implications for supply and quality. In another, funding for damage incurred in June 2011 only became available in 2013, with the municipality only commencing repairs in September 2014.

Such a prolonged timeframe between disaster and damage verification exercise is particularly challenging in the Western Cape, where high-impact weather exposures sometimes occur within weeks of each other. Table 6.1 shows municipalities which experienced two or more of the severe-weather

Table 6.1 Municipalities affected at least two times from 2011 to 2014 and associated damage costs

	Event				*Damage costs*	
Municipality	*2011*	*2012(2)*	*2013*	*2014*	*ZAR*	*USD*
Bitou	X	X			20,159,904	1,168,690
Breede Valley			X	X	40,820,000	2,366,377
George	X	X	X	X	129,902,600	7,530,586
Hessequa	X	X	X	X	215,808,279	12,510,625
Kannaland	X		X		95,793,409	5,553,241
Langeberg		X	X	X	53,726,900	3,114,603
Mossel Bay	X	X		X	62,648,501	3,631,797
Oudtshoorn	X	X	X		75,339,356	4,367,499
Swellendam	X	X	X	X	76,575,000	4,439,130
Total					**770,773,949**	**44,682,548**

Source: Pharoah et al. (2016)

events between 2011 and 2014, and the composite damage costs sustained by government departments, consolidated geographically by local municipality.[6] It shows that 9 out of the Western Cape's 24 local municipalities (38%) experienced repeated storms, with 3 municipalities impacted by all 5 events (marked in colour). In addition to recurrent exposures, there was also a short interval between events. The storms in 2012, for instance, occurred less than one month apart, while those in 2013 and 2014 were separated by a little over one month, leading to concatenating impacts.

In his report on the 2012 floods to the Premier of the Western Cape, the Minister of Local Government, Environmental Developmental Planning in the Western Cape drew attention to funding failures, arguing that a lack of funding contributed to the damage, especially in agricultural areas:

> Many rivers burst their banks, which caused widespread disruption and damage to surrounding areas. Several irrigation dams failed, and many riverbanks were washed away in the process. These areas require urgent protection from future floods to prevent substantial loss of agricultural soil. Previous damage was reported but no financial assistance was granted to protect the riverbanks that exacerbated the erosion of the riverbanks. The rehabilitation cost is now much higher than previously calculated. (Bredell, 2012, p. 6)

In some instances, municipalities reportedly redirected funds for scheduled maintenance to capital repairs, creating problems with respect to both risk reduction and funding following future disasters. Inadequate maintenance of stormwater infrastructure, for instance, could increase the risk of flooding, while insufficient maintenance could also make municipalities ineligible for recovery funding if infrastructure is affected by flooding at a later stage. The post-event research also showed that flood-affected

[6] This analysis was limited to the direct financial losses recorded by an organ of state that could be associated with an identifiable cut-off low. Loss data were obtained from the WCPDMC, as well as municipalities across the province. Data were also obtained from provincial departments of Agriculture, Cape Nature, DEADP, Education, Human Settlements, Social Development and Transport and Public Works, as well as the national Department of Water and Sanitation. Data on damage costs were also extracted from verification reports submitted to the NDMC.

municipalities frequently forfeited their access to recovery funding by making interim repairs to essential infrastructure (Pharoah et al., 2016).

Notably, municipalities experienced the same problem following the Knysna Fires. For example, Knysna Municipality's Electrical and Energy Services Department spent ZA R6.4 million (roughly US $492,000) on emergency repairs to restore essential electrical reticulation and infrastructure immediately following the fires. Some infrastructure was permanently repaired or replaced but some, such as transformers, were repaired temporarily using second-hand parts that had been replaced as they were reaching the end of their useable lifespan. However, because the electrical systems were functioning when the damage was assessed, they were not awarded the funding needed to make permanent repairs, leaving the municipality saddled with ageing and obsolete infrastructure.

6.6 Disincentives for Risk Reduction

The research on the flood events also suggests inadequate space for BBB in recovery grants. Although the WCPDMC and affected institutions recognise the importance of BBB, eligibility requirements often make this challenging. The research showed that where funding was approved, municipalities were limited to restoring infrastructure such as roads, pump stations, water pipes and bridges to pre-disaster specifications. Although the verification report proposed risk reduction measures to reduce the risk of future damage, upgrading infrastructure or altering the design or materials were not allowed, with funding only provided for replacing or repairing infrastructure damaged. This often resulted in repeated damage over the course of multiple events, and because repeated claims are prohibited, damaged infrastructure went unrepaired, particularly in small and under-resourced municipalities, resulting in progressively more damage in subsequent events. There was, however, one example where space was created for some risk reduction. The Department of Education co-funded the rebuilding of a severely damaged school, which provided an opportunity from some risk-reducing improvements, suggesting that resourcing and buy-in from 'risk owners' can help to address barriers to BBB.

Eligibility criteria also explicitly exclude some types of mitigation, although parameters can vary between events. For example, prospective measures such as protecting riverbanks can reduce soil losses and the impact of floods on farmers, in particular. The criteria used in verifying costs resulting from the events in 2011 and 2012 recognised funding for

the development and construction of new river protection works (Pharoah et al., 2016), but these were disallowed for the events in 2013 and 2014, where the brief included only current infrastructure that could be replaced or repaired (SRK Consulting, 2014). In the Central Karoo District Municipality, for instance, two projects to introduce river flood control measures (amounting to more than ZAR 14 million [approximately US $816,000]) were not approved. Out of the ZAR 18.4 million (US $1 million) claimed, for these and other measures, only ZAR 5.1 million (just over US $302000) was allocated (SRK consulting, 2014).

The post-event reviews also suggested that the availability of the disaster grants may serve to disincentivise proactive risk reduction. Interviews suggested that even municipalities and provincial departments that experienced flooding repeatedly seldom incorporated flood risk reduction into infrastructural maintenance and planning. The findings suggest that disasters have become normalised to some extent, and there is a dependence on post-disaster funding streams rather than planned investment financing that would integrate risk reduction into development processes (Pharoah et al., 2016). This dependence on disaster grants rather than other development funding instruments erodes a sense of local responsibility for risk reduction, including the need to BBB, and represents a symptom of authorities' larger failure to mainstream and fund risk reduction in South Africa. Overall, this undermines aspirations to strengthen local and provincial resilience to disasters, and drives an avoidable drain on municipal (as well as provincial and national) resources (Pharoah et al., 2016).

6.7 Building Back Better Strategies: Lessons to Be Learned

The post-event reviews of the Knysna Fires and the flood disasters identify several features in common with flooding and wildfires in other settings, particularly with respect to risk drivers. These include the difficulty of achieving a developmental approach to risk reduction, insufficiently risk-aware urban planning and inadequate risk mitigation by members of the public and property developers. The Knysna case study shows that lessons are not being learned, and there remains a disconnect between planning processes and disaster risk reduction. This reflects experience elsewhere, with Kim and colleagues (2015) arguing that it is critical for the planning profession to engage not only in disaster recovery but also in building long-term resilience. Home- and property-owners also need to play their

part by reducing fuel loads in the HIZ. This is important for prospective risk reduction, but where homes and buildings are already located in high-risk areas, engagement at this level is essential for tackling risk retrospectively. While changing laws to enforce building codes will be difficult, municipalities can help by introducing by-laws to support and enforce risk reducing practices, such as requiring defensible space around dwellings. The insurance industry could also help to support risk reduction by requiring policyholders to undertake measures to reduce risk.

The system itself, however, fundamentally hampers BBB. The findings from the case studies highlight the procedural and legislative barriers to both risk reduction and BBB in the Western Cape—and South Africa more broadly. BBB in South Africa is less affected by some barriers identified in the global literature, such as inadequate funding, weak bureaucratic structures or conflicting mandates. Despite the difficulties associated with operationalising the country's disaster risk management legislation, South Africa also has political will and a well-articulated legislative framework and policy commitment to BBB that should reduce the risk of disasters. There are funding instruments and procedures to assist in rehabilitating infrastructure and building risk reduction into recovery programmes, and South Africa has the capacity to do so. However, despite this promising institutional and legislative architecture, the system itself impedes BBB and fails to optimise the critical window created by high-profile disasters to make changes that reduce risk and build resilience. As the case studies illustrate, there is a clear gap between the laudable ambitions of the DMA and the NDMF and their implementation.

Sluggish funding mechanisms and counter-productive procedures are a core constraint, a barrier shared with other settings. While recovery requires agility and the rapid marshalling of resources (Mannakkara & Wilkinson, 2016), South Africa's post-disaster funding system suffers acutely from the institutional inertia identified elsewhere. Instead of providing a rapid injection of critical funding to promote immediate and longer-term recovery, the institutional machinery moves, to use Kim and colleagues' (2015) phrase, slowly and in complicated ways. This fundamentally undermines the policy commitment to BBB and, in some instances, may create and increase the risk of disasters. This includes a damage verification process that prevents, and in some cases penalises, entities for fulfilling their service delivery mandate—particularly in under-resourced municipalities. It must be recognised, however, that the government is in a difficult position in this respect, as procedures aim to achieve

the positive goals of ensuring accountability and preventing wasteful and fraudulent expenditure. There is nonetheless a clear need to revaluate and streamline processes to better support recovery—or develop alternative, more agile quick-release funding mechanisms to fund time-critical activities.

The integration of new funding streams, such as donations, into recovery could potentially increase the resources available to government institutions following disasters, and even provide quick-release stop-gap funding for recovery while lengthier procedural and oversight process are completed. However, this would require legislative changes, as existing compliance requirements prevent provincial departments from accepting donations. Municipal processes can accommodate external donations, but in the Knysna case, this proved administratively burdensome, suggesting that dedicated capacity would be needed to manage processes, or they could be outsourced to vetted non-governmental organisations, trusted by members of the public and other donors. Transparency and effective communication would be essential to avoid the controversy seen in Knysna.

The GRRI provides an interesting model for driving these and other aspects of recovery following large disasters, where multisectoral, joined-up decision-making is essential. However, the research highlights the pitfalls of imposing an externally driven platform without adequately engaging local stakeholders, signalling the need for a more inclusive approach to defining institutional arrangements, projects and implementation mechanisms. These would also need to mesh better with municipal and provincial funding and planning processes.

The analysis of the flood events also highlights the connections between events, and the concatenating impacts of the failures to BBB. In his discussion of recovery, following the 2002 volcanic eruption in Goma, in the Democratic Republic of the Congo, Wisner (2017) draws attention to the temporal dimensions of risk, and a need for greater attention to the cumulative nature of the processes that drive risk over time. This is also the case in the Western Cape. The flooding case study shows that the delays created by the slow disbursement of funding, and the regulations that prevent especially front-line departments from receiving money at all, establish a trajectory of risk accumulation that undermines any prospect of resilience building.

Notwithstanding their negative impacts, disasters provide a valuable opportunity for building resilience, with the recovery period following disasters providing a critical window for risk-reducing change. BBB features prominently in global frameworks, and despite some conceptual

critiques, is widely promoted as an important tool for disaster risk reduction. However, BBB often proves challenging in practice. The two cases studies described in this chapter illustrate a failure to learn from disasters in South Africa, alongside administrative and regulatory barriers to BBB. Unlike many developing countries, South Africa has the political will and resources to support BBB, but restrictive legislation and ponderous damage verification processes not only waist the opportunity created by disasters to reduce risk but can even increase it.

The case studies add to the body of experience from other countries regarding the challenges associated with BBB following disasters, and core lessons can be applied both in South Africa and elsewhere. Most centrally, they show that political commitment to BBB is insufficient to reduce risk; building a supportive regulatory environment and agile institutional processes are essential for successfully building back better. They also reaffirm the need for an all-off-society approach that engages the public and private sector as active role-players in risk reduction, as well as a longitudinal approach to understanding risk accumulation processes.

The findings also suggest more context-specific learnings. Most fundamentally, they support ongoing calls for enhancing mainstreaming of disaster risk reduction, to reduce the potential for disasters in the first place. This need is well-recognised by disaster risk management officials, but will remain challenging without changing the institutional placement of the function. The case studies also suggest a need to balance the recognised need for oversight of public spending and the time-critical nature of recovery and rehabilitation activities in post-disaster environments. This may require more creative and diverse mechanisms that develop additional funding streams and harness the capacities of non-governmental organisations and the private sector to mobilise and administer resources.

References

Benge, L., & Neef, A. (2020). Linking Disaster Risk Reduction to Development: The Evolution of 'Building Back. Better' in Neef, A and Pauli, N (eds.) International Disaster Management Frameworks, Climate-Induced Disasters in the Asia-Pacific Region: Response, Recovery, Adaptation. *Community, Environment and Disaster Risk Management series, 22*. https://doi.org/10.1108/S2040-7262202022

Bredell, A. (2012). *Report to Cabinet on Damage and Losses Caused by the Floods Which Occurred in the Overberg, Cape Winelands and Eden District Municipal Areas on 13 to 14 July 2012 and 8 to 10 August 2012 and to Request to Have the Disaster Classified as a Provincial Disaster*. Report to the Premier of the Western Cape. Local Government, Environmental Developmental Planning.

Cheek, W., & Chmutina, K. (2022). "Building back better" is neoliberal post-disaster reconstruction. *Disasters, 46*(3), 589–609. https://doi.org/10.1111/disa.12502

Clinton, W. J. (2006). *Key propositions for building back better: A report by the United Nations secretary-general's special envoy for tsunami recovery.* Retrieved November 30, 2022, from https://www.preventionweb.net/publication/key-propositions-building-back-better-lessons-learned-tsunami-recovery

Collodi, J., Pelling, M., Fraser, A., Borie, M., & Di Vicenz, S. (2021). How do you build back better so no one is left behind? Lessons from Sint Maarten, Dutch Caribbean, following hurricane Irma. *Disasters, 45*(1), 202–223. https://doi.org/10.1111/disa.12423. Accessed 30 November, 2022.

Davis-Reddy, C. L., & Vincent, K. (2017). *Climate risk and vulnerability: A handbook for southern Africa* (2nd ed.). Council for Scientific and Industrial Research (CSIR).

Fan, L. (2013). *Disaster as opportunity? Building back between in Aceh, Myanmar and Haiti.* Humanitarian Practice Network. Retrieved November 30, 2022, from https://odi.org/en/publications/disaster-as-opportunity-building-back-better-in-aceh-myanmar-and-haiti/

Fernandez, G., & Ahmed, I. (2019). "Build back better" approach to disaster recovery: Research trends since 2006. *Progress in Disaster Science, 1*, 10–14. https://doi.org/10.1016/j.pdisas.2019.100003

Financial and Fiscal Commission. (2012). *Optimal policy mix for managing and financing disaster risks in South Africa.* Financial and Fiscal Commission.

Forsyth, G., Le Maitre, D., Van den Dool, R., Walls, R., Pharoah, R., & Fortune, G. (2019). *The Knysna fires of 2017: Learning from the disaster.* Retrieved November 30, 2022, from https://www.researchgate.net/publication/333682368_THE_KNYSNA_FIRES_OF_2017_LEARNING_FROM_THIS_DISASTER

Garden Route District Municipality. (2020, June 5). *Recovery of indigenous vegetation following the 2017 wildfire disaster remarkable, but regrowth of invasive alien plants on a large scale a reason for concern.* Media release. Retrieved November 24, 2022, from http://www.gardenroute.gov.za/2020/06/06/media-release-article-recovery-of-indigenous-vegetation-following-the-2017-wildfire-disaster-remarkable-but-regrowth-of-invasive-alien-plants-on-a-large-scale-a-reason-for-concern/

Global Facility for Disaster Reduction and Recovery (GFDRR). (2015). *Building Back Better in Post-Disaster Recovery* (pp. 1–6). The Global Facility for Disaster Reduction and Recovery.

Holloway, A., Fortune, G., & Chasi, V. (2010). *Risk and development annual review.* Disaster Mitigation for Sustainable Livelihoods Programme (DiMP). https://www.preventionweb.net/files/16151_16151radar2010english1.pdf

IFRC. (2011). *Analysis of legislation related to disaster risk reduction in South Africa.* International Federation of Red Cross and Red Crescent Societies.

Islamabad, I., & Haris, M. (2019). Why lessons learnt are lost. Understanding the complexity of barriers to build Back better in Pakistan. *Disaster Prevention and Management, 28*(5), 677–690. https://doi.org/10.1108/DPM-04-2019-0103

Kim, K., & Olshansky, R. B. (2015). The theory and practice of building Back better. *Journal of the American Planning Association, 4363*(2014), 289–292. https://doi.org/10.1080/01944363.2014.988597

Kraaij, T., Baard, J. A., Arndt, J., Vhengani, L., & Van Wilgen, B. W. (2018). An assessment of climate, weather, and fuel factors influencing a large, destructive wildfire in the Knysna region, South Africa. *Fire Ecology, 14*(2), 1–12. https://doi.org/10.1186/s42408-018-0001-0

Macaskill, K., & Guthrie, P. (2018). Funding mechanisms for disaster recovery: Can we afford to build back better? *Procedia Engineering, 212*(2017), 451–458. https://doi.org/10.1016/j.proeng.2018.01.058

Madubula, N., & Van Niekerk, D. (2015). *Alternative Financing Mechanisms for Disaster Management in South Africa*. Submission to the 2013/2014 Division of Revenue Process. Retrieved December 1, 2022, from http://www.fcm.ca/home/programs/partners-for-climate-protection/alternative-financing-mechanisms.htm

Mannakkara, S., & Wilkinson, S. (2016). Selecting an institutional mechanism for building Back better: Lessons from Victorian bush fires recovery. *International Journal of Disaster Risk Reduction, 19*, 273–279. https://doi.org/10.1016/j.ijdrr.2016.08.025

Meiring, C. (2017, October 13). *Garden route: Post-fire plant regrowth patterns.* Southern Cape Landowners Initiative. Retrieved November 24, 2022, from https://www.scli.org.za/garden-route-post-fire-plant-regrowth-patterns/

National Disaster Management Centre (NDMC). (2005). *South African disaster management framework. Government Gazette*. Republic of South Africa. www.ndmc.gov.za/Documents/Legislation/framework.pdf.

National Disaster Management Centre (NDMC). (2017). *2017–18 disaster grant funding guidelines.* Department of Cooperative Governance and Traditional Affairs (CoGTA). Retrieved December 1, 2022, from http://www.ndmc.gov.za/Guidelines/2017-18DisasterGrantFundingGuidelines.pdf

Pelling, M., & Holloway, A. (2006). *Legislation for mainstreaming disaster risk reduction*. Tearfund. Retrieved November 28, 2022, from http://lib.riskreductionafrica.org/bitstream/handle/123456789/622/legislationformainstreamingdisasterriskreduction.pdf?sequence=1

Pharoah, R., Fortune, G., Chasi, V., & Holloway, A. (2014). *The Environment & Risk Reduction: Focus on urban risk*. RADAR.

Pharoah, R., Fortune, G., Lendrum, D., Schoonwinkel, P., & Cornellisen, L. (2019). *Feeling the heat: Post-event review of the June 2017 Knysna—Technical report*. RADAR.

Pharoah, R., Holloway, A., Fortune, G., Chapman, A., Schaber, E., & Zweig, P. (2016). *Off the RADAR—Summary report high impact weather events in the Western cape*. Research Alliance for Disaster and Risk Reduction (RADAR).

Rouhanizadeh, B., Kermanshachi, S., & Nipa, T. J. (2020). Exploratory analysis of barriers to effective post-disaster recovery. *International Journal of Disaster Risk Reduction, 50*, 101735. https://doi.org/10.1016/j.ijdrr.2020.101735

SRK Consulting. (2014). *Verification and costing of disaster damage of disaster declarations Western Cape: 15–17 November 2013 and 6–10 January 2014*. Report prepared for the Department of Cooperative Governance and Traditional Affairs, National Disaster Management Centre.

United Nations. (2016). *Report of the open ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*. United Nations. Retrieved June 1, 2021, from https://digitallibrary.un.org/record/852089?ln=en

United Nations Office on Disaster Risk Reduction. (2015). *Sendai framework for disaster risk reduction 2015–2030*. United Nations.

van Niekerk, D. (2014). A critical analysis of the south African disaster management act and policy framework. *Disasters, 38*(4), 858–877. https://doi.org/10.1111/disa.12081

van Niekerk, D., Coetzee, C., & Nemakonde, L. (2020). Implementing the Sendai framework in Africa: Progress against the targets (2015–2018). *International Journal of Disaster Risk Science, 11*(2), 179–189. https://doi.org/10.1007/s13753-020-00266-x

van Riet, G. (2009). Disaster risk assessment in South Africa: Some current challenges. *South African Review of Sociology, 40*(2), 194–208. https://doi.org/10.1080/21528586.2009.10425108

Vulcan Wildfire Management. (2018). *Situational analysis of the 2017 Knysna fires*. Vulcan Wildfire Management.

Walls, R., Moran, A., Van Straten, A., & Sander, Z. (2019). *The Knysna fires of 2017: Learning from this disaster technical report: Analysis and lessons learnt from the homes and structures which were damaged or destroyed in the incident*. Fire Engineering Research Unit (FireSUN).

Western Cape Disaster Management Centre (WCDMC). (2013, November 17). *Situation report 3: Flood situation report*. Unpublished Situation Report. WCDMC.

Wilgen, B. W., Van Measey, J., Richardson, D. M., Tsungai, A., & Wilson, J. R. (2020). *Biological invasions in South Africa*. Springer Open. https://doi.org/10.1007/978-3-030-32394-3

Wisner, B. (2017). "Build back better"? The challenge of Goma and beyond. *International Journal of Disaster Risk Reduction, 26*, 101–105. https://doi.org/10.1016/j.ijdrr.2017.09.027

CHAPTER 7

Generalisation and Prospects of Learning

Wolfgang Seibel

This volume's general focus is on the 'missing link' between the recognition of climate change in the form of global warming and the actual implementation of public policies to protect human life and property from the increasing threat of severe weather leading to wildfires and floods. This refers to what the United Nations Sendai Framework for Disaster Risk Reduction 2015–2030 described as the transition from disaster management to disaster risk management (UNDRR, 2015). Meanwhile, among the relevant intergovernmental bodies, a proactive approach to natural hazard risk assessment and mitigation is common sense. This holds for the United Nations Framework Convention on Climate Change (UNFCCC) as well as for the Conferences of the Parties (COP) or the UN Intergovernmental Panel on Climate Change (IPCC). Research on natural hazards risk management and related recommendations focus on identifying and classifying risks and countermeasures such as early warning, prevention and compensation (cf. the UNDRR's "Catalogue of evidence-based practices to reduce disaster risk", https://www.preventionweb.net/understanding-disaster-risk/disaster-risk-solutions).

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What these assessments and recommendations have in common, however, is that although they are evidence-based, they remain normative in nature. Similarly, previous scholarly analyses (e.g., Aldrich, 2012; Berke et al., 2010; Kunreuther & Useem, 2009) emphasised post-disaster learning when it comes to natural hazard risk mitigation. Which holds, specifically, for the neutralisation of cognitive biases and the strengthening of political preferences for long-term rather than short-term gains when it comes to recovery and prevention. What the case studies in this volume demonstrate is that policymaking and public planning alone will not guarantee risk mitigation and resilience. The rich body of empirical evidence on natural hazards and associated risk zones and the normative power of recognised best practices do not alter the fact that evidence-based knowledge on actual implementation issues is rare (cf. Nohrstedt, 2022, and Olson et al., 2020, for similar diagnoses). In their seminal paper, Olson et al. (2020) emphasise specifically the multiple gap between what meteorologists and civil engineers know, what policy researchers analyse and what policymakers do. As these authors put it: "The principal DRR [Disaster Risk Reduction] challenge is no longer purely the scientific understanding of hazards … nor is it so much the planning, architecture, engineering, or even the social science knowledge required to reduce or at least better manage risk. The principal DRR challenge now falls primarily in the policy and implementation realms and frankly in building increased public support for decision-makers and political leaders to champion stronger and more consistently applied DRR policies and programs" (ibid., p. 04020014-7).

This book's basic idea is a concept of risk assessment according to what David Crichton (2007) called the risk triangle consisting of hazardous environment plus exposure and vulnerability (see also IPCC, 2023, Glossary, pp. 119–130, for definitions, and Birkmann & McMillan, 2020, for an overview over related conceptual discourses). Climate change and the increasing number and geographical spread of natural hazards represent a risk in themselves whose actual impact, however, emerges from the interaction between exposure and vulnerability. While exposure results from spatial settlement patterns, vulnerability is linked to socio-political and cultural conditions that make the neutralisation or mitigation of natural hazards more or less likely. The chapters in this book illustrate how the consequences of natural hazards in terms of exposure and vulnerability can be ignored and even exacerbated by avoidable errors and neglect on the part of public authorities and policymakers.

These findings are consistent with what Olson et al. (2020) wrote about the fact that "disaster risk reduction (DRR) knowledge and

technology exist to significantly lessen the impacts of hazard events, but in many countries … it requires major policy changes and implementation actions by public officials, particularly at local levels" (ibid., p. 04020014-1). In this respect, the cases presented in this volume are peculiar and exemplary at the same time. They show that failure to mitigate the risk of natural hazards is not necessarily due to a lack of knowledge and experience. Nor is government inaction in dealing with the consequences of climate change necessarily due to inadequate institutional frameworks in the form of laws and state capacity. Instead, the disasters analysed happened in countries with viable democratic systems and public authorities guided by principles of responsible government. Moreover, since the risks of floods and wildfires were acknowledged in principle, legislation aiming at the protection of human lives and property was in place as well. Yet, the recognition of risks in terms of hazards, vulnerability and actual exposure did not translate into necessary measures while existing regulation was often simply ignored.

So, what the case studies presented in this volume suggest is that effective implementation of natural hazard risk mitigation is as much a matter of shared knowledge as it is a matter of political will and skill. Successful land use planning in the state of Victoria, Australia, in the course of which government agencies purchased tens of thousands of vacant lots in the wildland urban interface (WUI) fell prey to neo-liberal deregulation in the 1990s (Chap. 2). Illegally built houses and the absence of meaningful fire protection had been tolerated in East Attica, Greece, since the relevant authorities shied away from enforcing the law and making descendants of the original homeowners pay for mistakes for which they were not directly responsible (Chap. 3). Recommendations of a Grand Jury in Butte County, California, to enhance and upgrade potential escape routes in preparation for future wildfires were thwarted by so-called road diets in an effort to slow down traffic and to "beautify" main roads as attractive leisure and shopping areas (Chap. 4). Floodplains held in reserve in the event of flooding from the Rio de la Plata were eliminated in the city of La Plata, Argentina, in response to rapid urban growth and a shortage of affordable housing (Chap. 5). High-risk settlement patterns were replicated and risk reduction thwarted after devastating floods and wildfires in the Western Cape, South Africa, due to blurred and fragmented jurisdiction of relevant authorities, lack of coordination and overly diversified financing of "build back better" initiatives (Chap. 6).

While the cases themselves have an individual logic, the identified implementation issues— inappropriate mind sets, ill-conceived policies, poorly managed trade-offs, institutional impediments—are exemplary and thus generalisable in their own right. In terms of public policymaking, a general lesson concerns the reality check of implementation at the local level. It certainly makes sense to emphasise the potential of local social capital and the experience of real-world communitarianism as an indispensable source of resilience (cf. Hackerott, 2022, and Jerolleman, 2022). However, local communities and their political environment represent multi-facetted stakeholder arrangements that are not easy to integrate since they consist of different groups with vested interests and divergent preferences. What the case studies of this volume demonstrate is that effective public policy for the sake of natural hazard risk mitigation requires a mix of causal understanding and neutralising counterproductive stakeholder alliances that cannot be taken for granted.

Another way of generalising in order to learn from the policy failures described in this book is to contrast them with political successes in relevant areas. A widely acknowledged counterexample is the Dutch water management or Delta Approach (cf. van Buuren, 2019; van den Brink, 2010) which, indicative enough, was developed after a disastrous flooding in 1953 that claimed the lives of more than 1800 people and left some 100,000 homeless. The main components of the Delta Approach are levees, sluices and a rigid regime of standards and maintenance supervised and enforced by a powerful semi-autonomous public agency, the Rijkswaterstaat, that enjoys stable public acceptance and support. At the same time, the system was flexible enough to adapt to shifting policies of risk assessment including new governance structures that combine national strategy building with regional modifications and stakeholder participation coordinated by a Delta Commissioner, a position created in response to an evaluation report of 2008 triggered by the Hurricane Katrina disaster in Louisiana of 2005, and emphasising the consequences of climate change. Improved institutional capacity and the attraction of a successful history of "taming water" as a national achievement led to a coherent strategy of "consensual implementation" (van Buuren, 2019, p. 212).

The case studies in the previous chapters show how the absence of such mutually stabilising factors may increase rather than reduce exposure and vulnerability to natural hazards. The forward-looking land use strategy introduced in the 1950s in the Australian state of Victoria was not perceived or debated as a success story in public discourse. No institutional

backing existed for translating the sober analyses of the California Butte County Grand Jury report of 2009 into urban planning addressing the urgent challenge of wildfire hazards. No political agenda emerged in Greece for dealing with the decades-long practice of illegal construction in middle-class neighbourhoods near the East Attica sea shore whose irregular building patterns turned into death traps in the wildfire of 2018. In La Plata, Argentina, no coordination mechanism for the integration of infrastructure planning and local housing policy was established that could have limited the conversion of floodplains into residential areas that caused the catastrophic effects of the 2013 floods. In the Western Cape, South Africa, a coherent jurisdictional and funding system was in place that could, in principle, prevent the repetition of vulnerable settlement patterns after the floods and wildfires of the 2010s. However, regulatory bottlenecks mean that what is on paper does not materialise in actual public planning and reconstruction.

It is precisely because of the inconsistencies and shortcomings in public policies that have exacerbated the actual impact of wildfires and floods described and analysed in this volume that the cases themselves are instructive for generalisation and learning. This applies both to the analytical concepts and to the projection of action strategies, which are referred to below as disaster justice, the resilience paradox, probabilistic projections, stakeholder pluralism, institutional support, governance problems, second-best solutions and the prospects of learning.

Disaster justice—Social inequality is a major issue when it comes to the consequences of natural hazards. Spectacular disasters like Hurricane Katrina in 2005 made obvious that below-average income correlated with an above-average proportion of fatalities. Still, the notion of disaster justice (Lukasiewicz & Baldwin, 2020) deserves a more differentiated analytical concept. While it is true that, in general, countries and societal strata of low income are decisively more affected by, and have decisively less resources for coping with, the immediate consequences of floods and wildfires, let alone sustainable reconstruction, some cases analysed in this volume tell a different story. The wildfires in East Attica, Greece, of 2018 and in the town of Paradise, California, the very same year destroyed mostly middle-class dwellings. This happened not by mere coincidence. Both disasters were aggravated by the fact that existing knowledge about illegal construction (East Attica) or overly narrow traffic arteries for rescue and escape (Paradise) was ignored by the relevant authorities. The implementation of expert recommendations and/or the enforcement of

existing regulation could not count on acceptance, let alone support, in the respective local communities.

The resilience paradox—It follows from the above that the resilience of the local community as a social entity does not necessarily support resilience in the sense of robust invulnerability to natural disasters. The opposite may be the case, which holds for both middle-class and low-income communities. Risk reduction typically implies cost-intensive building or refitting of structures while risk-reducing spatial planning may collide with the very amenity of local settlements sought for by middle-class inhabitants. At the same time, the middle-class segment of local communities tends to be articulate and thus represents an important constituency that political parties or interest group representatives cannot easily afford to neglect. Hence, political actors and public authorities might be reluctant to enact and/or enforce risk-reducing regulation. Low-income communities are not natural allies of risk-conscious policymakers either. They may be even more reliant on resilient community life in existing habitats and they certainly face even more difficulties to bear the costs of refitting buildings and rising insurance premiums.

The problem of probabilistic projections—Another telling detail revealed by the cases analysed in this volume is the importance of an appropriate understanding of probabilistic versus deterministic logic. By definition, risk assessment is probabilistic in nature. Public policy based on risk assessment therefore requires appropriate reasoning and rhetoric that convincingly links measures to be taken in the public interest with meaningful assumptions about the consequences of inaction, usually with support of science-based professional expertise. The more complex the causality of risk-increasing factors and their interdependence, the more challenging the task of political communication in the effort to explain and to justify risk-reducing policies (cf. Bruneau, 2022, pp. 184–194, for a series of examples). However, the basic requirements are beyond reasonable doubt: factors and mechanisms that increase risk, once identified, must be contained in all circumstances where life and limb are at stake. This applies especially to the enforcement of existing regulations and legal frameworks but also to the maintenance and refitting of infrastructure such as dams or power lines, coordination gaps between relevant agencies, or to the vulnerability of settlements at the wild land urban interface (WUI). Nevertheless, the fundamental challenges for political decisions and legitimisation will remain since some risks and their underlying causes as well as the relevant countermeasures are easier to understand than others. Floods

and the protective infrastructure in the form of levees and floodplains are a typical example. In contrast, the risk of serious harm to human life and limb from bushfires is multi-layered and much more complex in nature. It includes intentional or unintentional arson, more or less reliable infrastructure such as power lines through forested areas, the intentional or accidental endangerment of settlements and the ability to alert, respond and rescue in the event of fire. While the clear deterministic logic of inadequate or failed dams and the consequences of flooding and loss of life and property typically trigger decisive mitigation measures such as the Dutch Delta Approach and its revitalisation after the "external shock" of Hurricane Katrina in 2005, bushfires like the ones that keep haunting south-east Australia typically remain without similarly effective initiatives. It is also significant that the public discourse following the Camp Fire in California and the forest fire in East Attica, both in 2018, was characterised by cacophony and political finger-pointing, which blurred rather than clarified the actual causality of the respective disasters and the massive loss of life and property (cf. Triantafillidou & Prodromos, 2023).

Stakeholder pluralism—The fuzziness of multi-causality and the difficulty of projecting and justifying public policies based on probabilistic arguments have their socio-political flip side in the form of stakeholder pluralism. The remaining uncertainty that, by definition, comes with risk assessment creates a grey zone of counterproductive misperceptions and illusions or even blunt denialism. The phenomenon itself is well known from other areas of risk assessment such as the linkage between smoking and lung cancer, drug consumption and addiction or virus infection and the spread of a pandemic. When it comes to natural hazards and protective measures of public policy, stakeholder pluralism reflects both productive and counterproductive perceptions and partial interests with various degrees of compatibility or incompatibility with the public interest. Alliances can emerge in which property owners and commercial property developers unite against the forward-looking land use policies of government agencies. Conversely, productive alliances can be forged between the insurance industry and homeowners to support government policies that promote mandatory home and property insurance with a government-guaranteed premium cap. Which, in turn, sheds light on another aspect of stakeholder pluralism which is participation for the sake of public support and legitimacy. As the example of the Dutch Delta Approach shows, stakeholder participation can be a decisive political force if it is based on the spirit of a common cause. Certainly, it must be acknowledged that the

clear and present danger of inundation in a country like the Netherlands with 26% of the surface below sea level and 60% susceptible to flooding differs from the usual bushfire setting or occasional flooding when rivers burst their banks after heavy rainfall. However, the logic of risk perception shaped by public discourse and related strategic communication is crucial since it can weaken or reinforce conventional wisdom about what is at stake and what can be done about it. That wisdom was lacking, for example, when in July 2017 the fire prevention fee paid by homeowners in California was sacrificed by Democrats in the state legislature in exchange for Republican agreement to extend California's cap-and-trade programme which promotes the reduction of carbon dioxide and other greenhouse gas emissions, for another thirteen years.

Institutional backing—The logic of political horse-trading, such as the suspension of California's fire fee in exchange for an extension of the cap-and-trade programme, also illustrates the importance of solid institutional backing for climate change and natural hazard risk reduction measures. Both the California Camp Fire of 2018 and the missed window of opportunity after the bushfires and floods in the Western Cape, South Africa, in the 2010s demonstrate the detrimental effect of lacking professional consensus and fragmented administrative jurisdiction. In an ideal world, managing natural hazards means organising response and rescue, infrastructure management and maintenance, the physical regulation of forests, rivers and coastlines, and spatial planning for land use and housing according to a comprehensive logic of complementary competencies, smooth cooperation and sufficient funding, beyond the logic of turfism and competition for resources.

Governance and the administrative state—It follows from the above that building resilience and natural hazard mitigation is as much a matter of sound government capacity as it is a matter of flexible governance that includes a variety of non-governmental actors. This is being reflected in the cooperation between municipal administration, fire departments, law enforcement agencies, volunteers, consulting firms or think tanks. Continuous evaluation and drills in anticipation of high-impact floods or fires are a core-component of such cooperation. However, the knowledge base and professionalism of the administrative state remain the back-bone of resilience and preparedness. Denying, let alone disrupting, administrative professionalism will inevitably result in serious threats to communities and loss of human life. Rather, it is pragmatism in the form of ad hoc initiatives and new alliances where the capabilities of public authorities may

be realised. For example, following the Camp Fire, the town of Paradise collaborated with the Insurance Institute for Business and Home Safety (IBHS) to develop self-imposed certification and inspection processes to make infrastructure more resilient and structures less ignitable (see Sect. 4.8 of this volume).

Second-best solutions and learning—Accordingly, efforts to achieve viable second-best solutions can make all the difference to the protection of human life and limb in the acute situation of extreme weather events. This applies in particular to the development and maintenance of infrastructure, the enforcement of existing legislation and the improvement of planning capacities and disaster response plans. However, second-best solutions are unlikely to trigger strategic learning—especially learning in the form of alternative land-use strategies under the condition of climate change. What the cases of improper handling of natural hazards analysed in this volume have in common is that judgement and recognition, even when present, did not result in such kind of learning. The "Marvellous Melbourne" success story of making metropolitan Melbourne "the world's most liveable city" (Blomkamp & Lewis, 2019) had its blind spot in the form of the neglected "future of the fringe" (Buxton & Butt, 2020) and the risk of bushfires and loss of life and property at the wildland urban interface surrounding the city. Changing political majorities and controversial debates about the causes of the catastrophic effects of the wild fires in Eastern Attica in Greece left the question of settlement patterns and illegal construction unresolved, although experts unanimously concluded that irregular settlement patterns and arbitrarily designated escape routes were largely responsible for the high number of casualties resulting from the wildfire of July 2018. The California Camp Fire of November 2018, while triggering intensive investigations into the vulnerability of critical infrastructure, did not lead to an assessment of the critical flaws in spatial planning, let alone the counterproductive political support for affordable housing for the middle class, that contributed to habitat vulnerability—which was powerfully demonstrated by the massive wildfires that engulfed much of Los Angeles in January 2025 (Nguyễn, 2025). The disastrous consequences of the conversion of floodplains into residential areas in La Plata, Argentina, have not led to a reorganisation of infrastructure and urban planning, whose fragmented character had favoured the violation of an urban development plan with a clear zoning of habitable and inhabitable plots. The floods and wildfires in the Western Cape, South Africa,

since the early 2010s could have paved the way for risk-reducing settlement patterns, yet the opportunity was missed.

Thus, the "blessings of disaster" (Bruneau, 2022) in terms of strategic learning remain a pious wish as long as basic elements of evidence-based learning are contested in the first place. Yet, even willingness to learn is a necessary but not sufficient condition of sustainable policy transformation. As Nohrstedt (2022) pointed out, strategic policy change is not just a matter of stakeholder mobilisation, agenda-setting, framing-contests, evaluation, consensus-building and decision-making but also a matter of long-term changes in social, economic, ecological and technological systems. Put another way, the most productive alliance for effective natural hazard risk reduction can be formed between visionaries and pragmatists.

References

Aldrich, D. P. (2012). *Building Resilience: Social Capital in Post-Disaster Recovery*. University of Chicago Press.

Berke, P., Cooper, J., Salvesen, D., Spurlock, D., & Rausch, C. (2010). Disaster plans: Challenges and choices to build the resiliency of vulnerable populations. *International Journal of Mass Emergencies & Disasters, 28*(3), 368–394. https://doi.org/10.1177/028072701002800304

Birkmann, J., & McMillan, J. (2020). Linking hazard vulnerability, risk reduction, and adaptation. *Oxford Research Encyclopedia of Natural Hazard Science*. Retrieved December 18, 2024, from https://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-145

Blomkamp, E., & Lewis, J. M. (2019). 'Marvellous Melbourne': Making the world's Most Liveable City. In M. E. Compton, & P. 't Hart (Eds.), *Great policy successes. Or, a tale about why it's amazing that governments get so little credit for their many every day and extraordinary achievements as told by sympathetic observers who seek to create space for a less relentlessly negative view of our pivotal public institutions* (pp. 180–200). Oxford University Press.

Bruneau, M. (2022). *The Blessings of Disaster. The Lessons that Catastrophes Teach us and Why our Future Depends on it*. Prometheus Books.

Buxton, M., & Butt, A. (2020). *The Future of the Fringe: The Crisis in Peri-urban Planning*. CSIRO Publishing.

Crichton, D. (2007). What Can Cities Do to Increase Resilience? *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 365*, 2731–2739.

Hackerott, C. S. (2022). Community Resilience and Crisis Management. In A. Farazmand (Ed.), *Global Encyclopedia of Public Administration, Public Policy, and Governance*. Springer. https://doi.org/10.1007/978-3-030-66252-3_726

IPCC. (2023). *CClimate Change 2023 Synthesis Report of the Intergovernmental Panel on Climate Change—Glossary* (pp. 119–130). doi: https://doi.org/10.59327/IPCC/AR6-9789291691647.

Jerolleman, A. (2022). Community Resettlement. In A. Farazmand (Ed.), *Global Encyclopedia of Public Administration, Public Policy, and Governance*. Springer.. https://doi.org/10.1007/978-3-030-66252-3_2873

Kunreuther, H., & Useem, E. (Eds.). (2009). *Learning from Catastrophes: Strategies for Reaction and Response*. Wharton School Publishing.

Lukasiewicz, A., & Baldwin, C. (2020). *Natural Hazards and Disaster Justice. Challenges for Australia and its Neighbours*. Palgrave Macmillan. https://doi.org/10.1007/978-981-15-0466-2

Nguyễn, T. (2025, January 18). California is Years Behind in Omplementing a Law to Make Homes more Fire Resistant. *Associated Press US News*. Retrieved April 9, 2025, from https://apnews.com/article/california-defensible-space-zone-zero-ember-resistant-73739a63eafc6239753152f19e7cc81f

Nohrstedt, D. (2022). When do Disasters Spark Transformative Policy Change and Why? *Policy & Politics, 50*(3), 1–17. https://doi.org/10.1332/030557321X16508834302815

Olson, R. S., Ganapati, N. E., Gawronski, V. T., Olson, R. A., Salna, E., & Sarmiento, J. P. (2020). From disaster risk reduction to policy studies: Bridging research communities. *Natural Hazards Review, 21*(2), 04020014-1-04020014-12. https://ascelibrary.org/doi/epdf/10.1061/%28ASCE%29NH.1527-6996.0000365

Triantafillidou, A., & Prodromos, Y. (2023). Coping with natural disasters: Political leadership framing of the 2018 wildfires in Greece. *Journal of Contingencies and Crisis Management, 31*(2), 212–225. https://doi.org/10.1111/1468-5973.12431

UNDRR. (2015). *United Nations office for disaster risk reduction Sendai framework for disaster risk reduction 2015–2030*. https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

van Buuren, A. (2019). The Dutch Delta approach: The successful reinvention of a policy success. In M. E. Compton, & P. 't Hart (Eds.), *Great policy successes. Or, a tale about why it's amazing that governments get so little credit for their many every day and extraordinary achievements as told by sympathetic observers who seek to create space for a less relentlessly negative view of our pivotal public institutions* (pp. 201–217). Oxford University Press.

van den Brink, M. (2010). *Rijkswaterstaat on the Horns of a Dilemma*. Eburon Academic Publishers.

Index[1]

[1] Note: Page numbers followed by 'n' refer to notes.

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https://doi.org/10.1007/978-3-031-98257-6