

# A SOCIETY-FIRST APPROACH TO FLOOD MITIGATION

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## **Abstract**

Flood mitigation involves the lessening or limitation of the adverse impacts of floods. The adverse impacts of floods often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions.

Floodplain managers tend to mainly use engineering techniques, urban planning and hazard-resistant construction for flood mitigation. After these strategies and actions have been put in place, the residual or unmanaged risk is then transferred to communities and emergency agencies for preparedness, response and recovery.

However, there is compelling evidence from around the world that shows that disasters are socially produced and their origins lie within the transferred residual risk. The causes of disasters are not found in nature, or the limitations of engineering and planning, but rather in the workings of society itself. Therefore, a key element of mitigating future flood disasters is to better understand the social forces that produce them, and then to take action to address those forces.

This paper explores psychological and sociological evidence from around the world to identify key society-first flood mitigation strategies. It finds that flood mitigation options should include the formation of social capital (trust, shared norms, networks), capacity building (e.g. leadership skills) and psychological resilience building (including for vulnerable populations).

There are several implications for floodplain managers related to these findings including the need to:

- Work with psychologists, sociologists and local council community development staff to couple existing flood mitigation strategies with society-first ones. This will further minimise residual risk in flood-prone communities.
- Broaden the scope of content in community flood education and engagement programs to include learning about the value of connected communities and ways to build personal resilience to help cope with a flood event.

## **Introduction**

'Managing the floodplain: a guide to best practice in flood risk management in Australia' (the Guide) (Australian Emergency Management Institute, 2013) provides a framework for the management of flood risk to those with roles in understanding and managing flood risk and its consequences on the community.

The Guide defines flood mitigation as "permanent or temporary measures taken in advance of a flood aimed at reducing its impacts" (p. 167). It is viewed as an important step in the goal of increased resilience to floods (p.xiii).

The Guide acknowledges that communities have an important role in providing advice and local knowledge about managing flood risk including mitigation measures. It encourages consultation with potentially-affected communities throughout the steps in its flood risk management framework including through reference committees, flood studies and floodplain management studies and plans.

The Guide also identifies three measures to address flood risks that directly relate to community response to flood events (p. 85):

1. Community flood awareness and readiness
2. Flood predictions and warnings
3. Emergency response planning to floods.

According to the Guide, these measures, coupled with flood behaviour modification measures and property modification measures, will provide reduction in flood risk. However, 'residual risk will always exist even after management measures, including mitigation and land use planning measures, are implemented' (p. 8). This residual risk is then transferred to flood-affected communities and emergency agencies to prepare for, respond to and recover from a flood.

## **A 'new' paradigm for managing flood risk**

There is a compelling body of research that shows that it is within this residual risk that the portents of a flood disaster lie. The research highlights that communities themselves are the core of flood risk and resilience i.e. that flood and other disasters are socially produced. Thus, a society-first approach to flood mitigation is required.

The society-first approach to managing hazards has evolved in the disaster management literature over the past fifty years. Traditionally, natural hazards and disasters have been treated through the lens of the physical domain. However, human and societal elements are important not only because people are the victims of environmental events that take place, but also because humans define the very essence of a 'natural' hazard.

Hewitt (1983) and many other researchers (e.g. Tobin and Montz, 1997; Forester and Krishnan, 2009) have shown that hazards are more dependent on the concerns, pressures, goals and risk-related decisions of society. The significant elements are social order, its everyday relations to the environment, and larger historical conditions that shape society.

Sociologist Ulrich Beck in his book 'Risk Society: Towards a New Modernity' (Beck, 1992) explains that western society has emerged through several forms to the current 'risk society', where people today mainly face risks that are associated with human decision-making. Evidence from major world disasters confirms that human decision-making was a major cause of the disastrous impacts e.g. inaction for warning systems in the 2004 Indian Ocean tsunami, Chernobyl disaster.

Several scholars including Mileti (1999) and Susman, O'Keefe and Wisner (1983) argue that present day disasters have been 'designed' by past decisions. Physical events set the stage for the occurrence of disasters, but disasters are largely the consequence of societal factors such as socio-economic and political conditions in the affected communities, processes that marginalise groups and individuals, rapid urbanisation, population vulnerability and inequality, unsafe development and construction.

“The crucial point about understanding why disasters occur is that it is not only natural events that cause them. They are also the product of the social, political and economic environment (as distinct from the natural environment) because of the way it structures the lives of different groups of people.” (Blaikie et al, 1994, p. 3).

Tierney (2014) explains that organisations and institutions are critical to the social production of risk, as well as cultural and social-psychological forces. People move through a range of organisations throughout their life e.g. school, work, clubs. Organisations may cause risks, contain risks, and be the victims of disaster. “The severity of risks and whether they increase or decrease over time are in large measure a function of the behaviour of organisations and institutions most directly involved” (Tierney, 2014, p. 44). Risks are also produced through cultural factors such as values, ideologies and culturally engendered cognitive styles.

Examinations of the determinants of recent disasters support these theories and research. Post-disaster evaluations of Hurricane Katrina (Boettke et al, 2007), the Great East Japan Earthquake (Aldrich, 2015), 2010 Chile tsunami (Marin et al, 2015), earthquakes and cyclones in Myanmar and Taiwan (James and Paton, 2015) and Hurricane Sandy (AP-NORC Center for Public Affairs Research, 2013) identify factors affecting response and recovery mainly related to social cohesion, institutions, organisations and culture. In Australia, government reviews/commissions into the 2009 Black Saturday bushfires and the 2011 Queensland and Victorian floods also identified major issues with socially-derived aspects including warning systems, institutions, emergency agency relationships and decision-making.

Several emergency agencies throughout the world have acknowledged socially-derived risk and included it in its mitigation and emergency planning. For example, the UK Environment Agency conducted several studies into managing the social aspects of flooding. The resultant technical report (Twigger-Ross, 2005) recommended “the need for flood risk management to be increasingly responsive to the social distribution and social impacts of flood risk”.

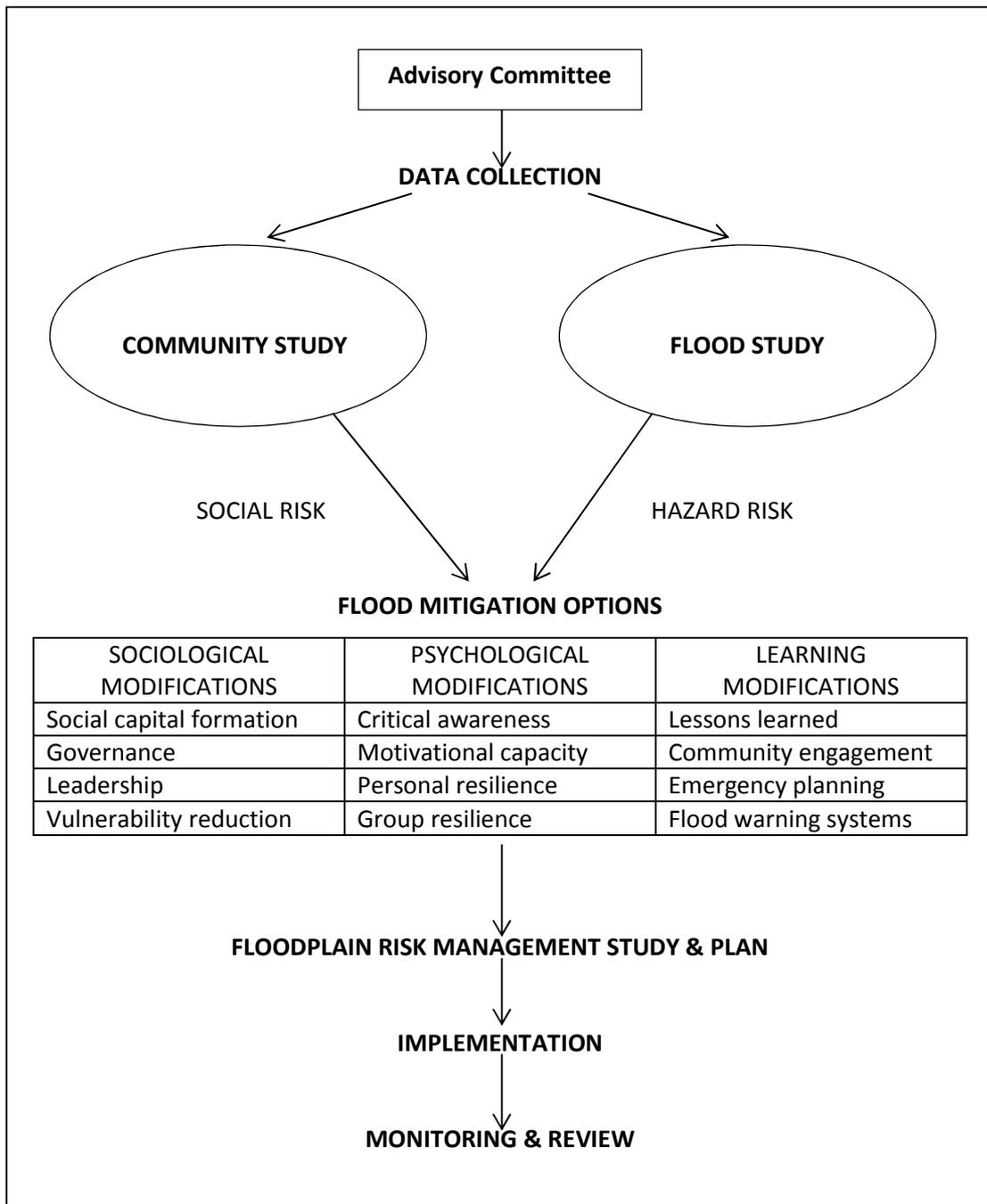
Given that risk is mainly produced and embedded within societies, a new approach to flood risk management in Australia should be investigated – one that includes flood mitigation as a social process.

## **A society-first flood risk management framework**

From the outset, it should be stressed that a society-first framework for the management of flood risk should not be confused with community preparedness activities carried out by emergency agencies and those people residing in the floodplain. The development of preparedness activities (e.g. personal flood plans, precautions) should occur separately whilst or after these society-related mitigation measures are implemented.

Figure 1 provides a society-first flood risk management framework similar to the steps outlined in the Guide. There are two differences to the Guide:

1. The addition of a Community Study to assess social risk that impacts on exposure and vulnerability
2. New flood risk mitigation options consisting of sociological options, psychological options and learning options.



**Figure 1: A society-first flood risk management framework**

***The Community Study***

The community study is an assessment of social risk in the flood-affected community. Coupled with the flood study it provides an examination of risks derived from flood exposure and social vulnerabilities.

The community study should include the following:

1. Community profile using census and other demographic data. Aspects that should be examined include gender distribution, age cohorts, education background, people per dwelling, types of dwelling, transience of the population, people requiring assistance, number of renters, levels of volunteering.

2. Social research. For example, most local councils conduct community surveys. These can provide information about social connections, use of community facilities, attitudes towards council and its services. It may be prudent to design and conduct social research to examine aspects of social structures such as existing jurisdictions, organisations, leadership, risk awareness and personal resilience
3. Social network analysis. At a high level this can include the analysis of the Community Directory available on the websites of many local councils. This will provide details of community groups and linkages in the community being studied. However, more detailed social network analysis involves the mapping and measuring of relationships and flows between people, groups, organisations, computers, URLs, and other connected information/knowledge entities. Specialised consultants and computer programs can provide these outputs which can then be used to assess social cohesiveness and capital.
4. Vulnerability assessment. Vulnerability is the propensity to suffer some degree of loss from a hazardous event (Etkin et al, 2004). Cannon (1994) finds that mitigation rarely addresses the major determinants that make people vulnerable i.e. social, economic, and political factors that shape the level of resilience of people's livelihoods and their ability to withstand and prepare for hazards. A vulnerability assessment can provide details of specific inherent risks in the community including relating to social inequalities and power bases. There are several publications that provide detailed vulnerability frameworks (e.g. Birkmann ed., 2006).

### ***Sociological modifications***

As shown in Figure 1, the four recommended sociological measures to mitigate flood risk are:

1. Social capital formation
2. Governance
3. Leadership
4. Vulnerability reduction

Social capital has been defined as the 'networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit' (Putnam, 1995). It consists of those bonds created by belonging to a group that instils trust, solidarity, and cooperation among members.

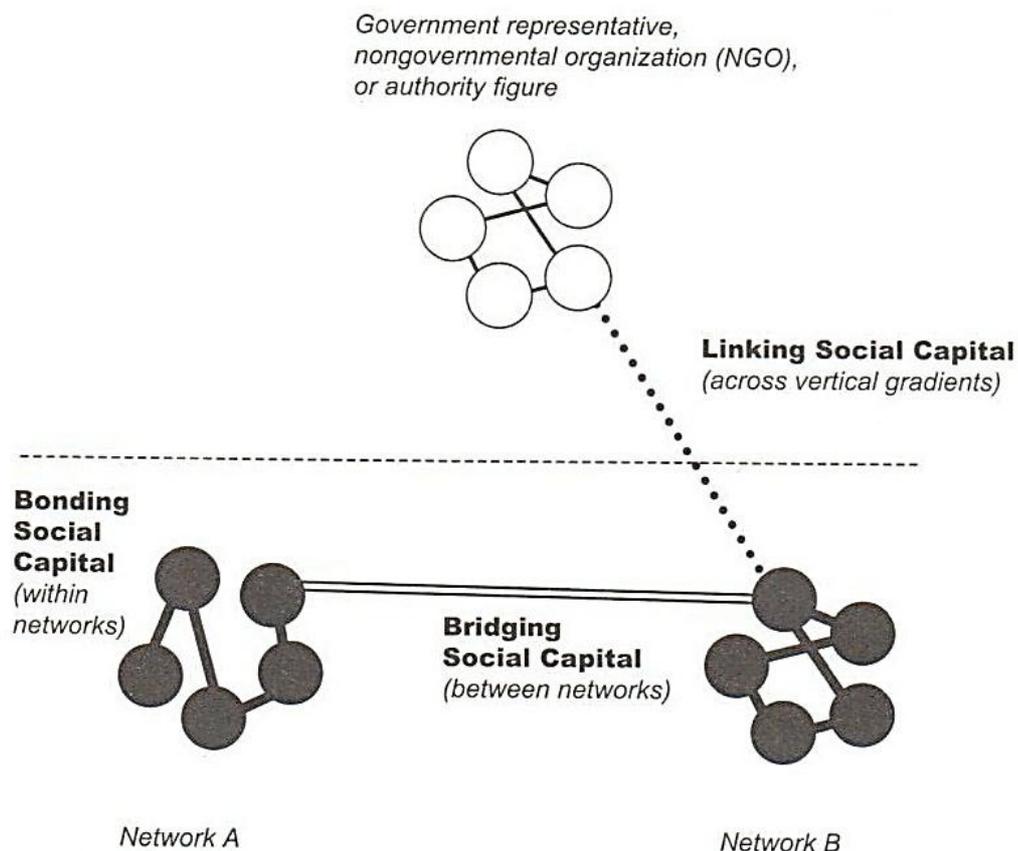
It is generally agreed that there are three distinct forms of social capital (see Figure 2):

- 'Bonding social capital' grows from organisations and activities connecting similar individuals who often live in close proximity to each other e.g. neighbours, friends, families.
- 'Bridging social capital' grows from bringing together individuals from different neighbourhoods, ethnicities and races e.g. through employment, education, sporting club, church.
- 'Linking or governance social capital' grows from linking individuals and organisations to institutions to enable them to make decisions about the management and distribution of a community's overall resources. This could include volunteering for an emergency agency and participation on a local council committee. Where bridging social capital connects individuals of approximately equal social status, linking social capital connects those of unequal status, providing them with access to power.

The importance of social capital in disasters has been well documented. For example, according to Schellong (2007), during and after a disaster “social systems continue to operate while new ones emerge because they have greatest knowledge of the community, and because they need to initiate recovery themselves as many of their needs will not be met by outside agencies”. Haines, Hurlbert and Beggs (1996) found that disaster victims and their social networks mostly become resources that can be used in disaster response and recovery.

Research into the recovery from recent disasters such as the 2004 Indian Ocean tsunami (e.g. Aldrich, 2011), the Haiti Earthquake (e.g. Nolte and Boenigk, 2011) and Hurricane Katrina (e.g. Boettke et al, 2007; Chamlee-Wright, 2010) has shown the benefits of social capital in providing resources for a faster and more efficient recovery.

However, there were some negative effects of social capital found in the research. For example, in villages in Southeast India impacted by the 2004 tsunami, although high levels of social capital reduced barriers to collective action for members of the *uur* panchayats (hamlet councils) and parish councils speeding up their recovery and connecting them to aid organisations, at the same time social capital reinforced obstacles to recovery for those outside of these organisations such as women, Dalits, migrants, and Muslims (Aldrich, 2011).



**Figure 2: Bonding, bridging, and linking social capital (from Aldrich, 2012, p. 34)**

There are several websites that show how to form social capital including <http://www.bettertogether.org/150ways.htm>. An example of a program to improve life after a disaster through the use of social capital formation is the Neighbourhood Partnerships Network in New Orleans (see <http://www.npnnola.com/about/>).

Governance involves the management of institutions and organisations that affect the impacts of floods. According to Handmer and Dovers (2013, p. 38), “institutions are persistent, predictable arrangements, laws, processes or customs serving to structure transactions and relationships in a society...Organisations are manifestations of underlying institutions – specific departments, associations, agencies etc.”.

Risk can relate to the interrelationships between emergency management organisations before, during and after a flood. For example, investigations into the 2011 Victorian floods (Victorian Government, 2011) found issues with these interrelationships and called for better interoperability arrangements.

Furthermore, an ongoing source of risk generation involves continuing development within floodplains that increases exposure (a function of risk). It is institutions (e.g. legislation) and organisations (e.g. local councils, state government agencies) that approve and even promote this increased risk. Even mitigation options implemented by organisations such as levees may in fact increase societal risk. For example, the ‘levee paradox’ has been shown to exist in several communities where the levee designed to reduce flood risk actually increases it, as the presence of levees encourages development in floodplains.

“The greatest task in this sense is not the specific design of singular institutional mechanisms, even if the poor design and subsequent failure of one such mechanism may have tragic circumstances. It is the recognition of the more complex institutional system, and the coordination and optimal function of that system.” Handmer and Dovers (2013, p. 174)

Leadership has been shown to be a major factor in effective disaster preparedness, response and recovery. For example, then Premier Anna Bligh was widely praised for leading response and recovery efforts in the 2011 Queensland floods.

This mitigation option includes the identification of, training and support for local community leaders for floods. For example, some communities have identified local leaders that liaise with emergency managers and lead appropriate community actions before, during and after a flood.

Vulnerability reduction involves a range of activities to attempt to reduce vulnerabilities prior to a flood. Given that  $\text{risk} = \text{hazard} \times \text{exposure} \times \text{vulnerability}$ , the reduction of social vulnerability is an important flood mitigation task.

Removing inequalities in communities, redistributing socio-political power and establishing support networks for potentially vulnerable people in disasters (e.g. older, disabled, children) can help reduce vulnerability.

Moreover, as Turner et al (2003) stress, vulnerability is registered not by exposure to hazards alone; it also resides in the resilience of the system experiencing the system. With this in mind, Berkes (2012, p. 37) identifies four ways to reduce vulnerability to hazards:

1. Strengthening community-based management
2. Building cross-scale management capabilities
3. Strengthening institutional memory
4. Nurturing learning organisations and adaptive co-management.

## ***Psychological modifications***

As shown in Figure 1, the four recommended psychological measures to mitigate flood risk are:

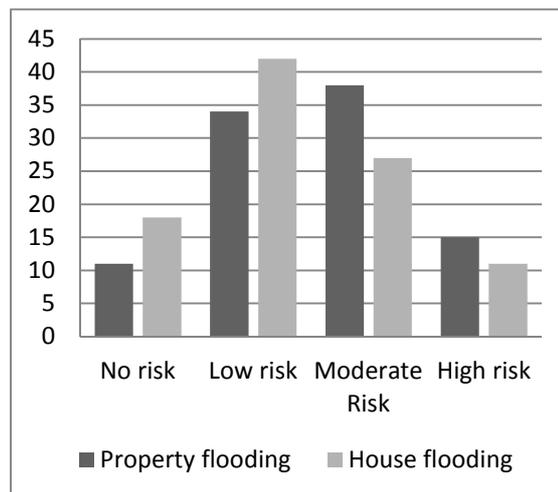
1. Critical awareness
2. Motivational capacity-building
3. Personal resilience
4. Group resilience

Several researchers have found that critical awareness is an important foundation for people to prepare for hazard events. “Critical awareness describes the extent to which people think and talk about a specific source of adversity or hazard within their environment”. (Paton and McClure, 2013, p. 103)

Critical awareness taps into the degree to which people perceive that issues such as flooding are important to them. Methods to increase critical awareness about flooding include encouraging real-life stories of flood experiences (oral histories), inviting community groups to be involved in scenarios relating to how to deal with floods and listening to knowledgeable community leaders and floodplain managers.

Motivational capacity-building involves people becoming more motivated to become engaged in the flood disaster cycle of mitigation, preparedness, response and recovery. If people are not motivated to become engaged, they then can become disenfranchised from disaster management and thus more vulnerable to loss of life or injury in a flood event. They most probably will not purchase flood insurance.

It is common to find a relatively high percentage of people residing in floodplains that are unaware of their flood risk. For example, as shown in Figure 3 approximately 18% of those living in high risk flood-prone parts of Fairfield City (Sydney) did not know that they were at risk of above-floor flooding (Molino Stewart, 2012).



**Figure 3: Perception of flood risk from those living in high-risk Fairfield City floodplains (source: Molino Stewart, 2012)**

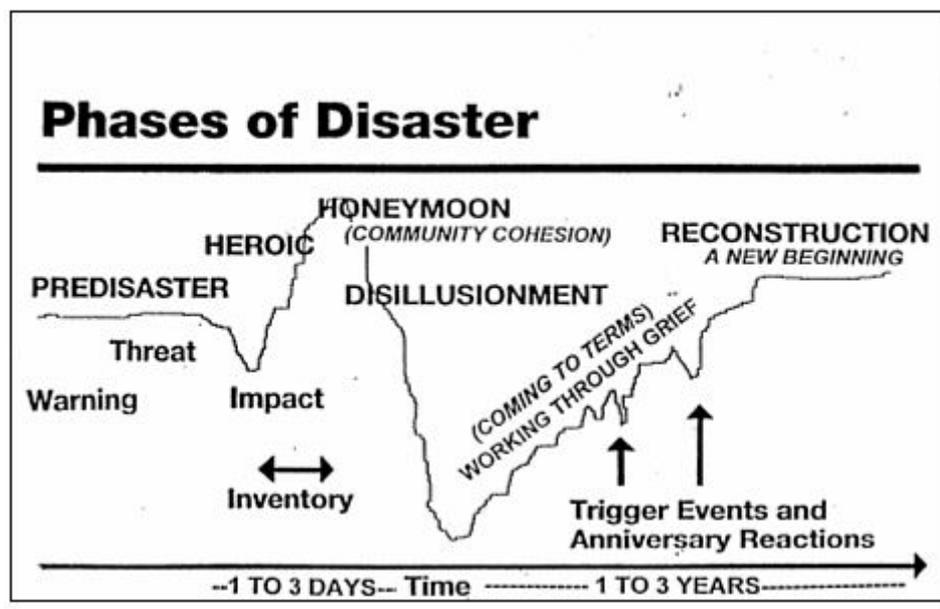
Apart from critical awareness, improving risk perception and building anxiety can help motivate people to engage in the disaster cycle (Paton and McClure, 2013). However, anxiety can mean that people can also transfer the responsibility of their safety to others, including emergency agencies.

Activities to improve motivational capacity-building for flooding include the provision of flood risk information through property notifications, ongoing engagement of residents with floodplain managers and the establishment of local resident support nodes or networks related to flood risk.

Personal resilience. Recent research in Australia shows that increases in family violence and mental health problems due to the stress of natural disasters outweighs the cost of rebuilding infrastructure (Deloitte Access Economics, 2016). Figure 4 depicts the emotional phases that an individual (either a survivor or a responder) might experience as a result of a major traumatic event.

There are ways to build personal resilience prior to disasters so that mental health impacts such as post-traumatic stress disorder (PTSD) are reduced. An excellent article that provides a non-technical coverage of learning personal resilience can be found at <http://www.newyorker.com/science/maria-konnikova/the-secret-formula-for-resilience>

Possibly the field of Positive Psychology which promotes well-being and happiness, can assist in people building their resilience capabilities: <https://www.psychologytoday.com/blog/finding-light-in-the-darkness/201602/second-wave-positive-psychology-introduction>



**Figure 4: Emotional phases that an individual (either a survivor or a responder) might experience as a result of a major traumatic event (source: CDC, 2016)**

Group resilience. The resilience of groups (e.g. families, organisations, communities) can also be developed in the mitigation stage. It should not be assumed that the resilience of individuals alone will minimise post-flood mental health impacts; adaptive strength will also be obtained through group interactions and support mechanisms.

Examples of ways to develop group resilience to disasters can be found at <http://wwwapp1.bumc.bu.edu/lphi/publichealthtraining/onlinecourses/ep-stress/EP-Stress9.html>

## ***Learning modifications***

As shown in Figure 1, the four recommended psychological measures to mitigate flood risk are:

1. Lessons learned
2. Community engagement
3. Emergency management planning
4. Flood warning systems

Lessons learned include the evaluations of previous floods within the geographic area but also those from other areas where learnings can be transferred. These evaluations can occur prior to a flood event (e.g. to gauge effectiveness of a community education preparedness program) and after events (e.g. after action reports, reviews, commissions of inquiry).

Flood evaluations can provide critical information to inform future floodplain and emergency planning. However, flood evaluations in Australia are generally carried out in an *ad hoc* fashion, with no consistent implementation and evaluation standard measures, and are rarely released to affected communities (Dufty, 2013).

Lessons learned also include the local knowledge of those living in floodplains. The Victorian Flood Review (Victorian Government, 2011) was particularly scathing of the lack of recognition by emergency agencies of local knowledge in the 2010/11 Victorian floods. It recommended that “the state take necessary measures to require that local knowledge is considered in flood risk planning, including verification of flood maps and flood response plans”.

It is in the flood mitigation phase that community engagement mechanisms and networks should be put in place to enliven community discourses about flooding and build relationships with emergency agencies. The Community Study described above should be used to guide development of these community engagement mechanisms and networks, which then can be used for preparedness education and to assist learning related to warning, response and recovery.

Several studies have provided empirical evidence to demonstrate the value of community-agency engagement. For example, Frandsen et al (2012) demonstrated the value of fire agency representatives actively engaging with community members to facilitate wildfire planning and preparedness.

Social media are being used as important community engagement mechanisms for disaster risk reduction in Australia and around the world (Dufty, 2015). Virtual learning communities of practice are being established linking people globally in disaster management e.g. the use of the Twitter hashtag #smem for those people wanting to learn more about social media for emergency management.

There is evidence to show that communities should participate in emergency management planning, which traditionally has been the preserve of emergency agencies. The benefits of participation in emergency management planning (e.g. the preparation of local flood plans) include acquiring new information from discussions with people, learning new skills, being involved with important issues, personal recognition and gaining a sense of community (Dalton, Elias and Wandersman, 2007).

Participation in emergency management planning can empower community members by linking them with experts. This will “increase the likelihood of their taking

responsibility for their safety and adopting their role in a comprehensive risk management plan". (Paton and McClure, 2013)

Flood warning systems should be designed and tested in the flood mitigation stage. Warnings provide a signal to those at risk from flooding so they can take action to improve their safety and reduce losses. Numerous studies (e.g. Parker, Tunstall and Wilson, 2005) have calculated the economic benefits of installing effective flood warning systems.

In Australia, the concept of the 'total flood warning system' (TFWS) has been used to describe the full range of elements that must be developed if flood warning services are to be provided effectively. The lead guiding document for the development of the TFWS in Australia is Manual 21 – Flood Warning (Attorney-General's Department, 2009).

There is evidence to suggest that community-based flood warning systems have added economic and societal benefits (Gautam and Phaiju, 2013).

## **Discussion**

'Managing the floodplain: a guide to best practice in flood risk management in Australia' provides best practice guidance to Australian floodplain managers. This guidance largely assumes that floods are caused by forces extraneous to humans, with technological solutions mainly used to treat flood risk. Little acknowledgement is made in the Guide of societal forces that are largely the source of flood risk.

Mitigation methods to not only treat the flood hazard, but also the underlying societal forces of the potentially affected communities, are here recommended as best practice for Australian floodplain management.

"The prevention and mitigation of hazards and disasters are possible not only by intervening in physical domains, but also (and more effectively) by changing and modifying societal forces..." (Haque and Etkin, 2012, p. 9)

To achieve this, the above social-based framework for flood mitigation should be coupled with the flood studies and risk management measures promoted in the Guide.

The assessment and implementation of measures in the social-based framework for flood mitigation are far outside the capabilities of those involved in floodplain management (e.g. engineers, town planners, flood modellers, emergency managers). It therefore critical for existing floodplain managers to enlist psychologists, sociologists and local council community development staff to couple existing flood mitigation strategies with society-first ones. It is also important to broaden the scope of content in community flood education and engagement programs to include learning about the value of connected communities and ways to build personal resilience to help cope with a flood event.

The fused mitigation measures will ensure that the residual flood risk to communities is further reduced. They will also build stronger community flood resilience as the societal measures have generally been found to have more community resilience benefits than engineering or planning solutions.

"Like risk, resilience also has its origins in the social order...Social networks and social capital form the basis for resilient response and recovery but those

advantages are often in short supply within vulnerable populations. When disaster strikes, resilient responses reflect the capacity for creativity and innovation, but that capacity can be thwarted when groups lack resources or are unable to act.” (Tierney, 2014, p. 227)

## Conclusion

This paper outlines and argues for an alternative paradigm to that promoted by the Australian Government for floodplain risk management. The alternative paradigm, based on extensive evidence gleaned over at least fifty years, revolves around flood risk and resilience being located primarily within social forces and structures including social capital, vulnerability, institutions, organisations and power relationships.

A societal framework for flood mitigation is unpacked highlighting a range of social, psychological and learning measures to reduce risk. The framework also includes the use of a community study to better understand demographics, social networks and vulnerabilities.

A fusion of the existing Australian floodplain risk management practices with the society-first ones promoted in this paper is recommended. To implement this mix, the ‘team’ of floodplain managers will need to be expanded to include sociologists, psychologists and educators.

## References

Aldrich, D.P., 2011, The Externalities of Social Capital: Post-Tsunami Recovery in Southeast India, *Journal of Civil Society*, Vol. 8, No. 1, pp. 81-99.

Aldrich, D.P., 2012, *Building resilience: social capital in post-disaster recovery*, University of Chicago Press, Chicago.

Aldrich, D.P., 2015, It's who you know: Factors driving recovery from Japan's 11 March 2011 disaster, *Public Administration*, Article first published online: 8 Aug 2015, Wiley Online Library.

AP-NORC Center for Public Affairs Research, 2013, *Two Years after Superstorm Sandy: Resilience in Twelve Neighborhoods*, accessed 8/3/2016 at [http://www.apnorc.org/pdfs/sandy/sandy%20phase%20%20report\\_final.pdf](http://www.apnorc.org/pdfs/sandy/sandy%20phase%20%20report_final.pdf)

Attorney-General's Department, 2009, *Manual 21 Flood Warning*, *Australian Emergency Manuals Series*, Commonwealth of Australia.

Australian Emergency Management Institute, 2013, *Managing the floodplain: a guide to best practice in flood risk management in Australia*, Australian Emergency Management Handbook Series, Commonwealth of Australia.

Beck, U., 1992, *Risk Society: Toward a New Modernity*, Sage, London.

Berkes, F., 2012, Understanding Uncertainty and Reducing Vulnerability: Lessons from Resilience Thinking, In C.E. Haque & D. Etkin eds., *Disaster risk and vulnerability*:

*mitigation through mobilizing communities and partnerships*, McGill-Queen's University Press, Montreal.

Birkmann, J., ed., 2006, *Measuring vulnerability to natural hazards: towards disaster resilient societies*, United Nations University Press, Tokyo.

Blaikie, P., Cannon, T., Davis, I. & Wisner, B., 1994, *At Risk: Natural Hazards, People's Vulnerability and Disasters*, Routledge, London.

Boettke, P., Chamlee-Wright, E., Gordon, P., Ikeda, S., Leeson, P.T., & Sobel, R., 2007, The Political, Economic, and Social Aspects of Katrina, *Southern Economic Journal*, Vol. 74, No. 2, pp. 363-376.

Cannon, T., 1994, Vulnerability analysis and explanation of 'natural' disasters. In *Reducing Risk through Partnerships: Proceedings of the 1st CRHNet Symposium*, Canadian Risk and Hazards Network, Winnipeg.

CDC, 2016, *Disaster Mental Health Primer: Key Principles, Issues and Questions*, accessed 9/3/2016 at <http://emergency.cdc.gov/mentalhealth/primer.asp>

Chamlee-Wright, E., 2010, *The Cultural and Political Economy of Recovery: Social Learning in a Post-Disaster Environment*, Routledge, New York.

Dalton, J.H., Elias, M.J., & Wandersman, A., 2007, *Community psychology: linking individuals and communities (2<sup>nd</sup> ed.)*, Wadsworth, Belmont, CA.

Deloitte Access Economics, 2016, *The economic cost of the social impact of natural disaster*, report prepared for The Australian Business Roundtable for Disaster Resilience & Safer Communities.

Duffy, N., 2013, Evaluating emergency management after an event: gaps and suggestions, *Australian Journal of Emergency Management*, Vol. 28, No. 4, pp. 15-19.

Duffy, N., 2015, The use of social media in countrywide disaster risk reduction public awareness strategies, *Australian Journal of Emergency Management*, Vol. 30, No. 1, pp. 12-16.

Etkin, D., Haque, E., Bellisario, L., & Burton, I., 2004, *An assessment of natural hazards and disasters in Canada*, The Canadian Natural Hazards Project, Public Safety and Emergency Preparedness Canada and Environment Canada, Ottawa.

Forester, J., & Krishnan, R.K., 2009, Rethinking risk management policies: from 'participation' to processes of dialogue, debate and negotiation. In U.F. Paleo, ed., *Building Safer Communities: Risk Governance, Spatial Planning and Responses to Natural Hazards*, NATO Science for Peace and Security Series E: Human and Societal Dynamics Vol. 58, pp. 34-43.

Frandsen, M., Paton, D., Sakariassen, K., & Killalea, D., 2012, Nurturing community wildfire preparedness from the ground up: Evaluating a community engagement initiative, In D. Paton & F. Tedim, eds., *Wildfire and community: Facilitating preparedness and resilience*, Charles C Thomas, Springfield, Illinois.

Gautam, D.K., & Phaiju, A.G., 2013, Community Based Approach to Flood Early Warning in West Rapti River Basin of Nepal, *Journal of Integrated Disaster Risk Management*, published online 28/06/2013, DOI:[10.5595/idrim.2013.0060](https://doi.org/10.5595/idrim.2013.0060).

Haines, V.A., Hurlbert, J.S., & Beggs, J.J., 1996, Exploring the Determinants of Support Provision: Provider Characteristics, Personal Networks, Community Contexts, and Supporting Following Life Events, *Journal of Health and Social Behavior*, Vol. 37, No. 3, pp. 252-264.

Handmer, J., & Dovers, S., 2013, *Handbook of disaster policies and institutions: improving emergency management and climate change adaptation: 2<sup>nd</sup> edition*, Routledge, New York.

Haque, C. E., & Etkin, D., 2012, Introduction: Dealing with Disaster Risk and Vulnerability: People, Community and Resilience Perspectives, In C.E. Haque & D. Etkin eds., *Disaster risk and vulnerability: mitigation through mobilizing communities and partnerships*, McGill-Queen's University Press, Montreal.

Hewitt, K., ed., 1983, *Interpretations of Calamity*, Allen and Unwin Inc., London.

James, H., & Paton, D., 2015, Social Capital and the Cultural Contexts of Disaster Recovery Outcomes in Myanmar and Taiwan, *Global Change, Peace & Security: formerly Pacifica Review: Peace, Security & Global Change*, DOI: [10.1080/14781158.2015.1030380](https://doi.org/10.1080/14781158.2015.1030380)

Marín, A., Bodin, O., Gelcich, S., & Crona, B., 2015, Social capital in post-disaster recovery trajectories: insights from a longitudinal study of tsunami-impacted small-scale fisher organizations in Chile, *Global Environmental Change*, Vol. 35, pp. 450-462.

Mileti, D., 1999, *Disasters by Design: A Reassessment of Natural Hazards in the United States*, National Academies Press, Washington, DC.

Molino Stewart, 2012, *Community flood education and awareness in Fairfield City*, report prepared for Fairfield City Council.

Nolte, I., and Boenigk, S., 2011, *Public-Private Partnership Performance in a Disaster Context: The Case of Haiti*, Public Administration Review.

Parker, D., Tunstall, S., & Wilson, T., 2005, *Socio-economic benefits of flood forecasting*, International conference on innovation advances and implementation of flood forecasting technology, Norway.

Paton, D., & McClure, J., 2013, *Preparing for disaster: building household and community capacity*, Charles C Thomas, Springfield, Illinois.

Putnam, R., 1995, Bowling Alone: The Collapse and Revival of American Community, *Journal of Democracy*, Vol. 6, pp. 65-78.

Schellong, A., 2007, *Increasing Social Capital for Disaster Response through Social Networking Services (SNS) in Japanese Local Governments*, National Centre for Digital Government No. 07-005.

Susman, P., O'Keefe, P., & Vogus, T.J., 1983, Global Disasters, A Radical Interpretation, In K. Hewitt ed., *Interpretations of Calamity: From the Viewpoint of Human Ecology*, pp. 263-283, Unwin Hyman, New York.

Tierney, K.J., 2014, *The social roots of risk: producing disasters, promoting resilience*, Stanford University Press, Stanford, California.

Tobin, G.A., & Montz, B.E., 1997, *Natural Hazards: Explanation and Integration*, Guilford Press, New York and London.

Turner, B.L., Kasperson, R.E., Matson, P.A., et al., 2003, A framework for vulnerability analysis in sustainability science, *Proceedings of the National Academy of Science of the United States*, Vol. 100, pp. 8074-79.

Twigger-Ross, C., 2005, *Managing the social aspects of flooding: Synthesis Report*, Joint Defra/Environment Agency Flood and Coastal Erosion Risk Management R&D Programme, R&D Technical Report SC040033/SR6.

Victorian Government, 2011, *Review of the 2010-11 Flood Warnings and Response: Final Report*, report by Neil Comrie AO, APM.