CONSERVING AND RECONNECTING FLOODPLAINS TO MITIGATE FLOOD RISK

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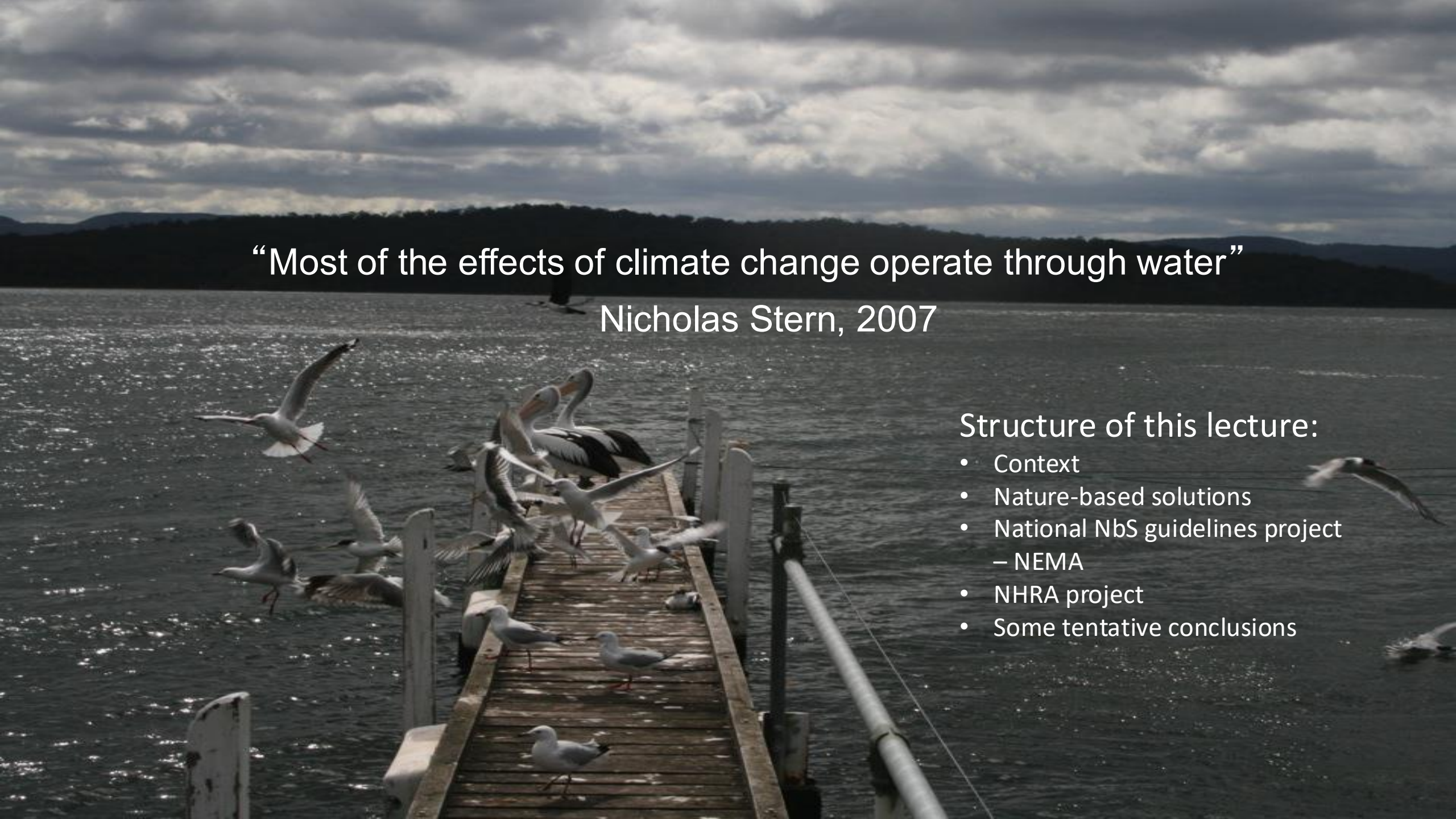


"Most of the effects of climate change operate through water"

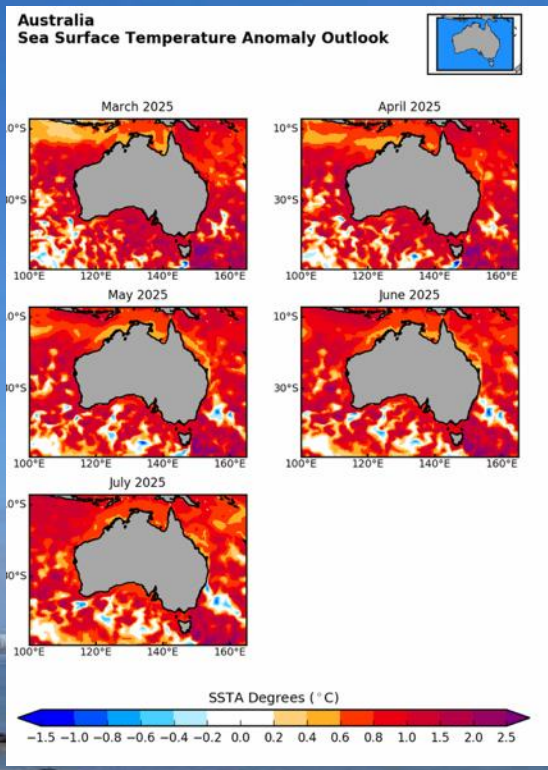
Nicholas Stern, 2007

Structure of this lecture:

- Context
- Nature-based solutions
- National NbS guidelines project – NEMA
- NHRA project
- Some tentative conclusions

Climate change context:

- More extreme weather events,
- More fires, floods and droughts – think Australia 2000-2025
- Warmer oceans
- Heavier rainfall
- Cyclone belt shifting south



Socio-economic context

- Housing crisis
- Expanding cities
- Population growth
- Degraded catchments
- Incremental land use planning

Nature-based Solutions:

1. are inspired and powered by nature
2. address challenges or resolve problems
3. provide multiple benefits, including biodiversity gain
4. Need to be effective and economically efficient.

OECD POLICY PERSPECTIVES: NATURE-BASED SOLUTIONS FOR ADAPTING TO WATER-RELATED CLIMATE RISKS (2020)

Nature inspired solutions for flood mitigation can

1. Reduce flood risk
2. Maintain / restore catchment ecology and hydrology e.g. connections between rivers and flood-plains.
3. Improve water quality
4. Enhance habitats
5. Mobilise communities
6. Be integrated with catchment management and NRM

ANU project – 2022-2025

Partnering with Regional Communities to Develop Guidelines for Nature-based Solutions to Flooding

- NEMA funded

Fire and Rescue NSW/AAP

Guidelines for Nature-based Solutions for flood resilience - ready to publish

Multi-disciplinary team including Roslyn Prinsley, Jeremy Smith, Mehdi Sedighkia, Susan Hunt, Katie Menzies, Prabhasri Herath, Tony Webster, Jason Alexandra, Barry Croke, Ana Cordova, Nicole Falconer, Monique Manning, Laura Chen.

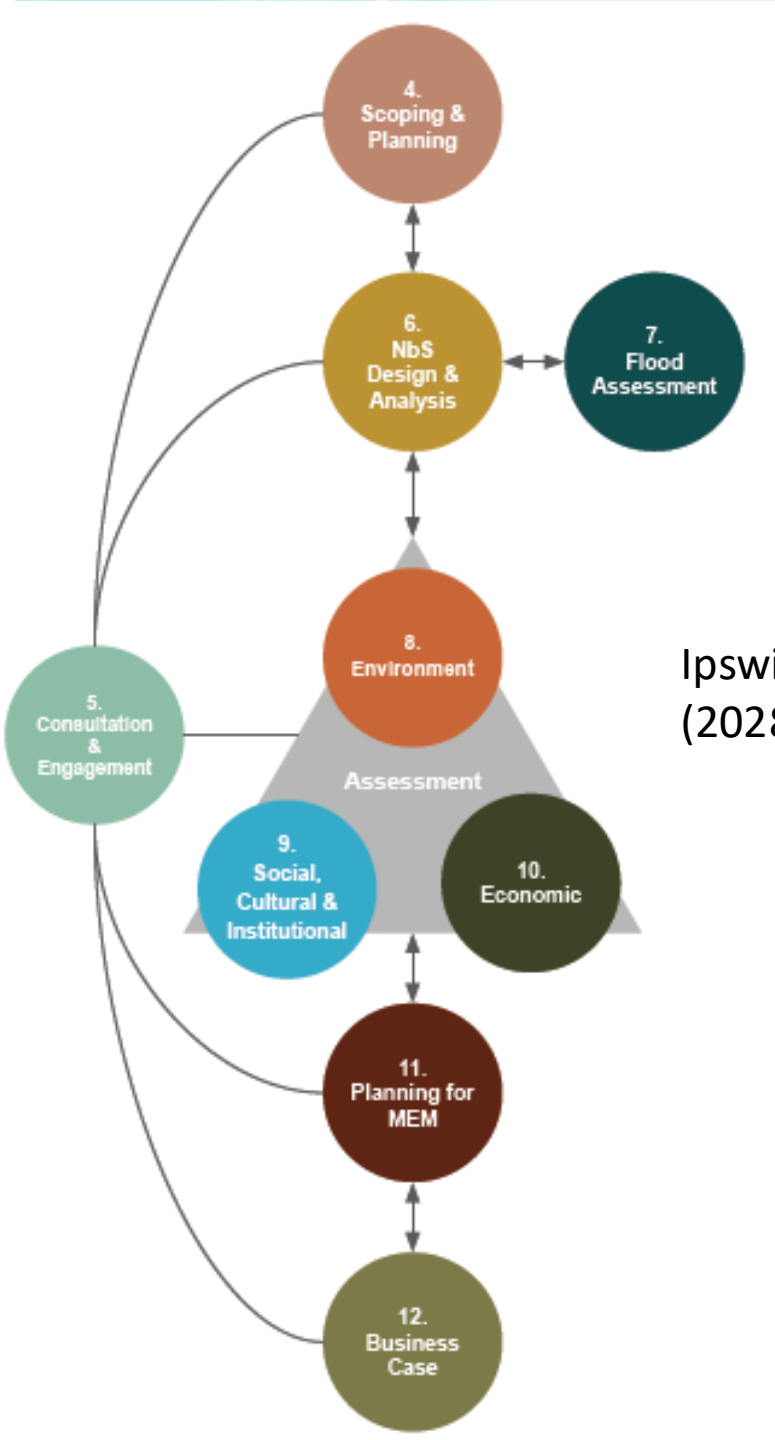
Funded by National Emergency Management Australia (NEMA)

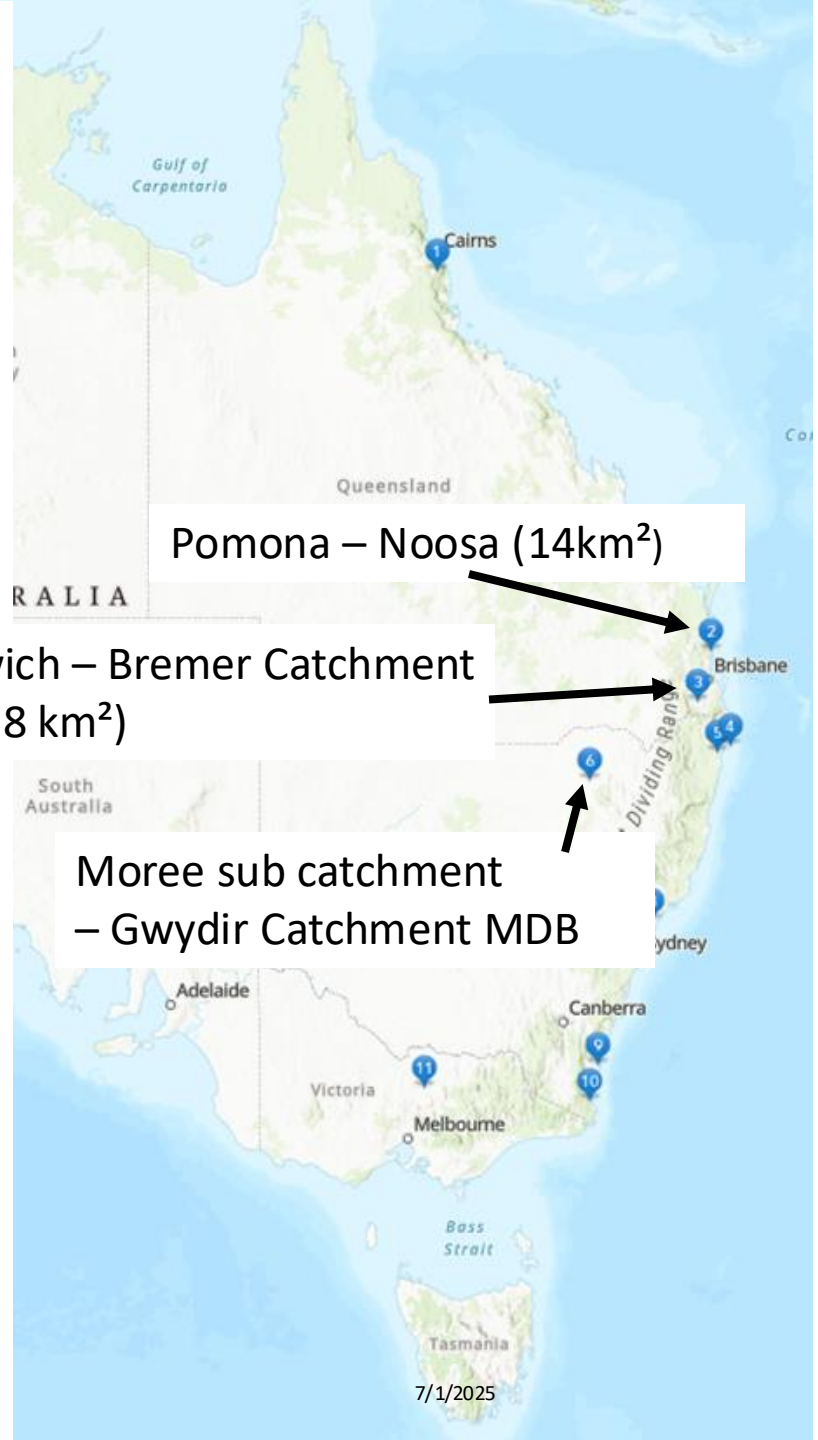
Australian Guidelines to Nature-based Solutions to Mitigate Flooding

Chapter 1	Introduction to NbS for flood mitigation in Australia
Chapter 2	Nature-based Solutions for flood mitigation
Chapter 3	Assessment framework
Chapter 4	Scoping and Planning
Chapter 5	Community engagement
Chapter 6	NbS design and analysis
Chapter 7	Flood Assessment
Chapter 8	Environmental Assessment
Chapter 9	Social, cultural & institutional considerations & assessment
Chapter 10	Economic Assessment
Chapter 11	Monitoring, evaluation and maintenance
Chapter 12	Making a convincing business case
Chapter 13	Catchment studies and projects from Australia and abroad

Australian national guidelines for NbS for flooding

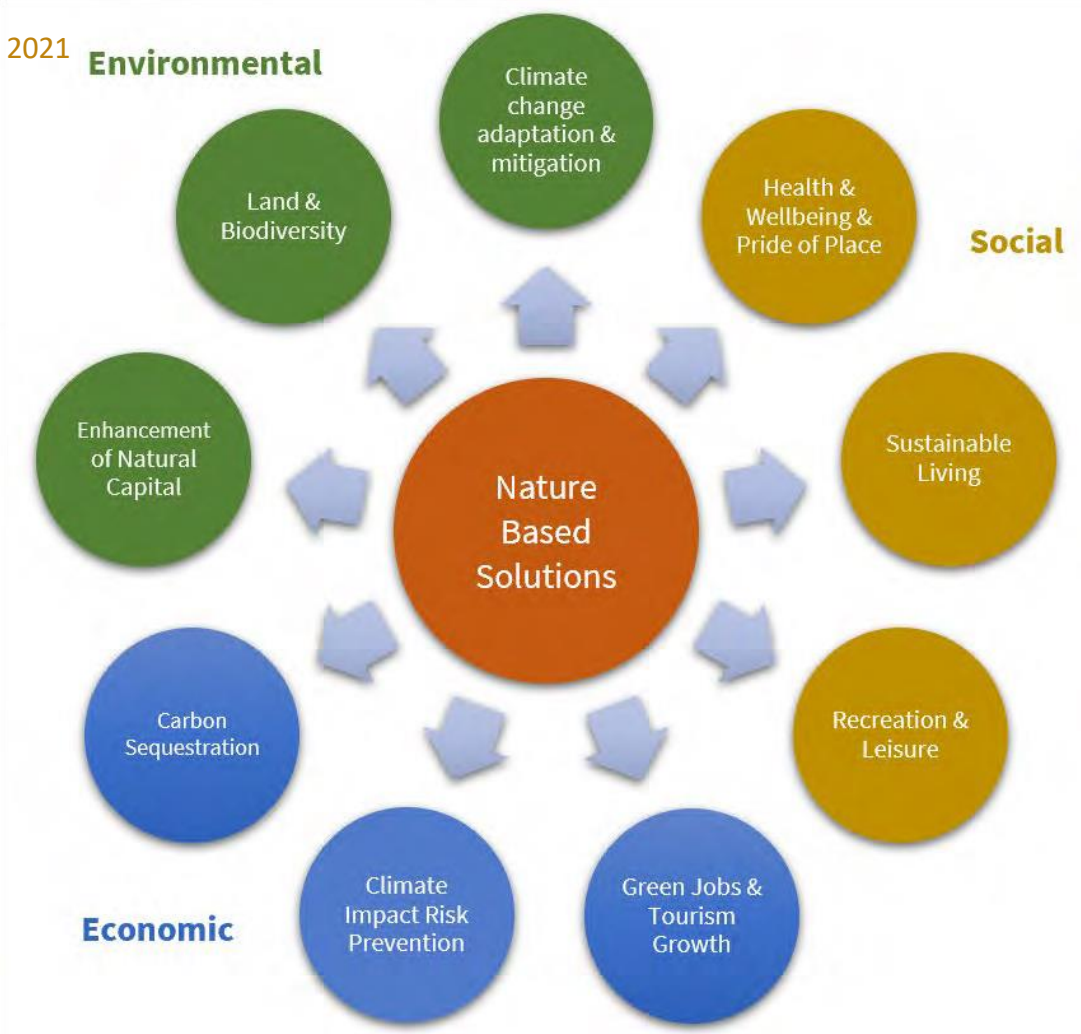
Assessment framework developed through six case studies





Co-benefits of Nature-based Solutions for Flooding

FEMA 2021



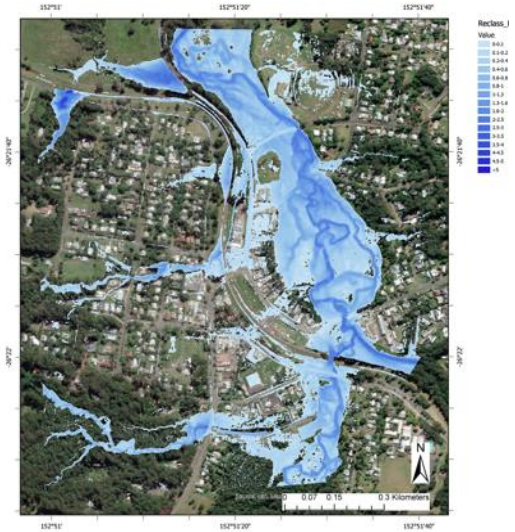
NbS initiatives must balance:

- **R**esilience
- **R**esistance
- **R**isk
- **R**edundancy
- **R**eturn on investment

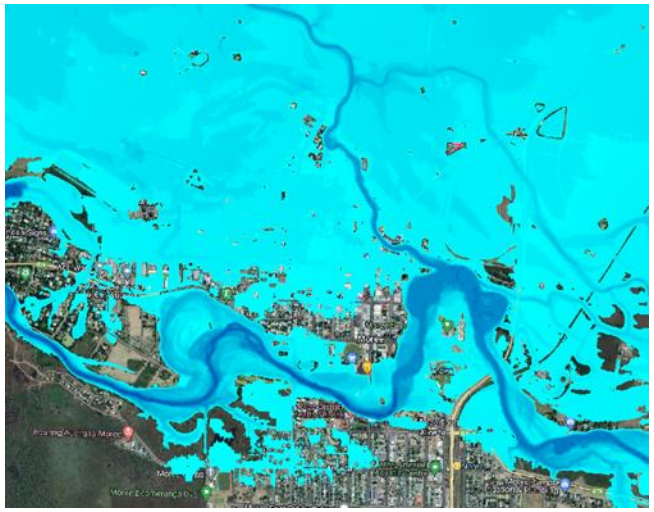
Socially acceptable, technically feasible ecologically benefical and economically responsible

Six catchment studies including:

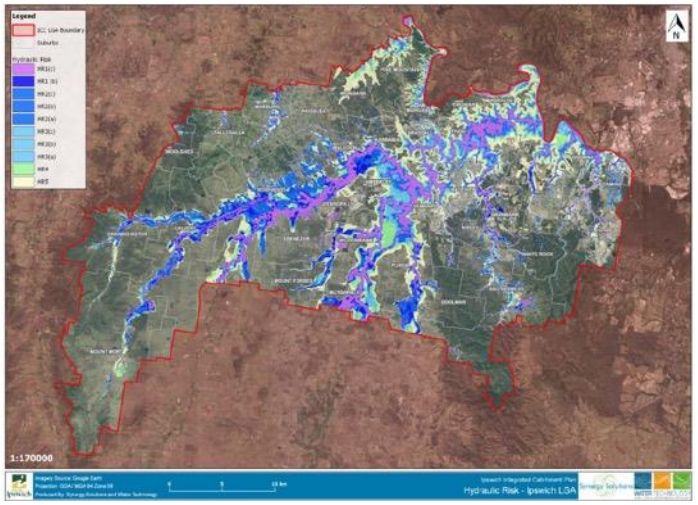
Pomona – Noosa (14km²)



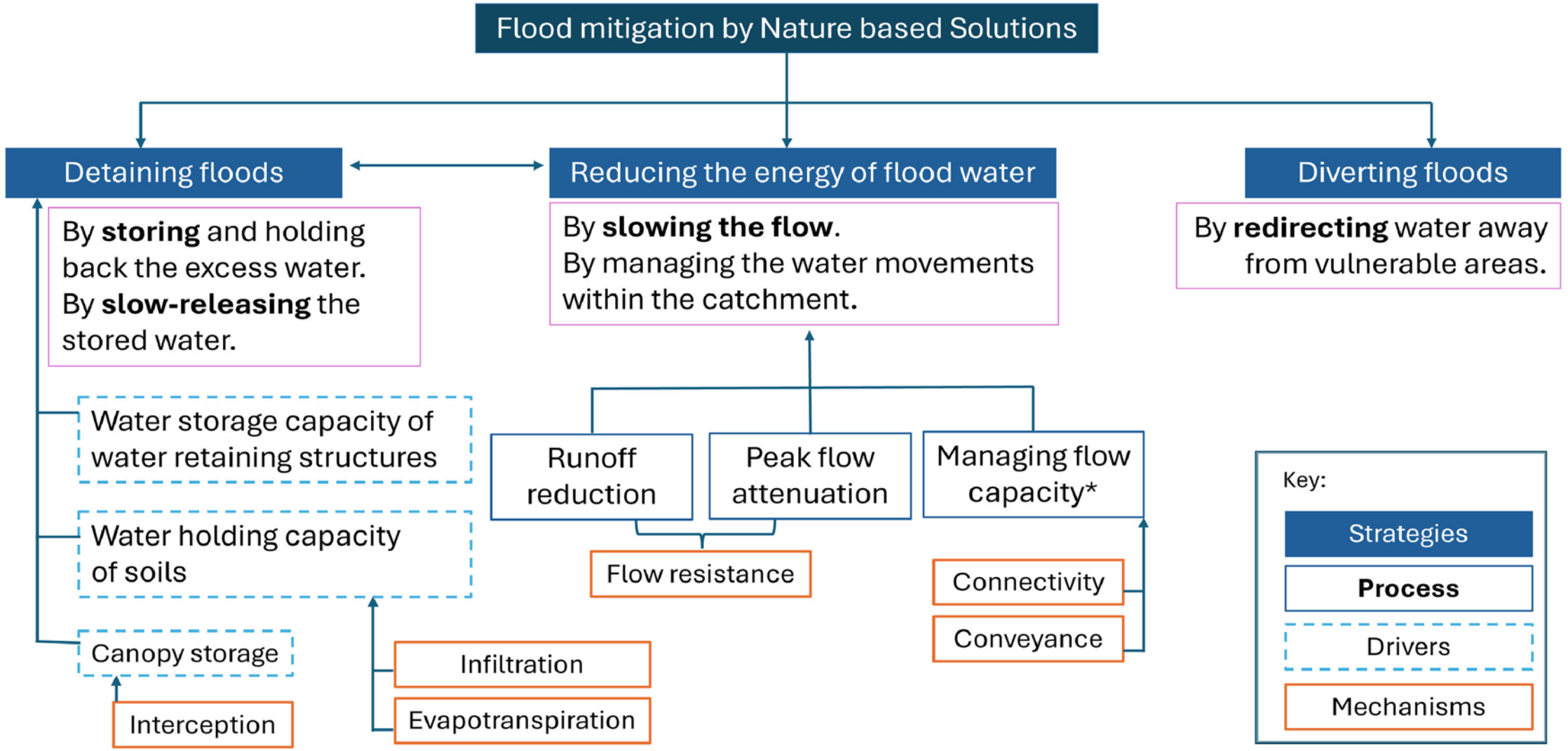
Moree – Gwydir Catchment



Ipswich – Bremer Catchment (2028 km²)



How do NbS Work?



Prabhasri Herath, Roslyn Prinsley, Barry Croke, Jai Vaze, Carmel Pollino,
A bibliometric analysis and overview of the effectiveness of Nature-based Solutions in catchment scale flood mitigation, Nature-Based Solutions, Volume 7, 2025,

Categories of Nature-based Solutions

1. Landscape Solutions

Catchment-based solutions

2.4.1.1

Forest cover

Grasslands & Shrublands

Agriculture Land Cover & Practices

Surface Permeability
(including urban solutions)

Stream & floodplain based solutions

2.4.1.2

Managing the Stream Channel

- → Channel restoration
- → Riverbed restoration

Floodplain Reconnection

- → Floodplain restoration & preservation
- → Room for the river[1]

Riparian Vegetation[2]

- → Vegetation in banks, riparian buffers up to floodplain boundaries

2. Storage solutions

2.4.2

Wetlands[3]

Offline Retentions[3]

Online Retentions[3]

Flow Barriers[4]

3. Diversion solutions/ Alternative routes

2.4.3

Natural Channels

- → Palaeochannels

NbS project related non-natural channels[1]

- → Bypass / high-water channels

Leaky weirs (retention basins/online storage)

Flood mitigation

- Control overflow during high-flow events
- Reduce erosion/sedimentation
- Enhance connections with floodplain

Co-benefits

- Water quality improvement
- Groundwater recharge
- Maintain environmental flows
- Habitat diversity
- Low risks construction

NbS for flood mitigation: flow barriers/leaky weirs

Examples

- In the UK's Upper Calder Valley, midstream weirs reduced peak flows by 16.6% for 1-year events.
- In Mexico, gabion structures decreased peak flows by 46% for 10-year events and by 13.6% for 100-year events.
- In Australia's Pomona catchment, modelling showed that leaky weirs could reduce urban flood depths by 30%.
- Pomona - opportunity for installation in former plantation lands

No simple solutions - need diagnostic and design-based approaches

Leaky weirs are one important intervention – there are more – see for example the Guide to stream rehabilitation (LWA 2000)

Not all streams and floodplains are the same - need characterization of river types/styles

Slowing water can restore landscapes

Tendency to simplify stream and floodplain processes and generalize applications and findings

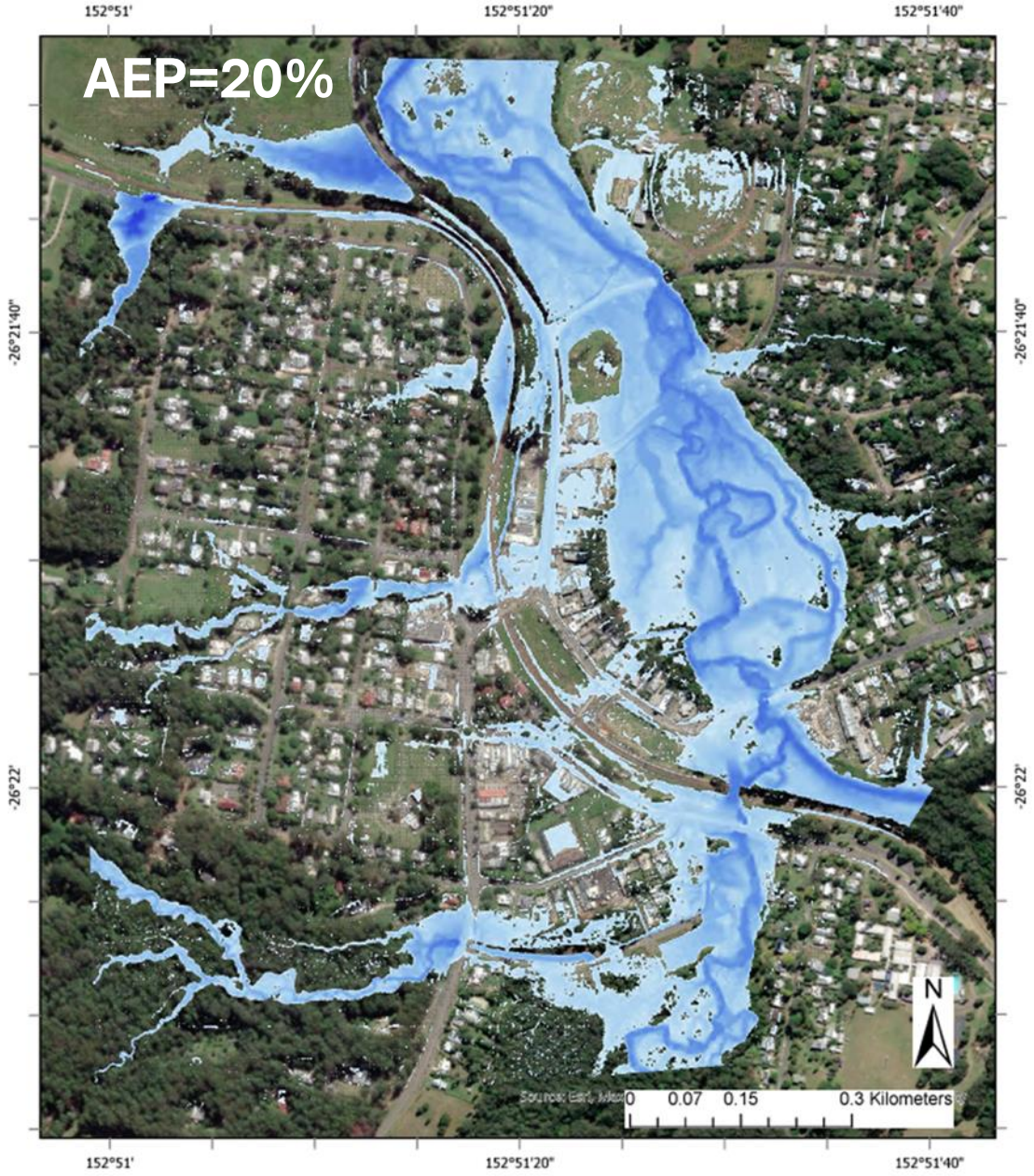
Theory and principles help explain impacts of practices and interventions

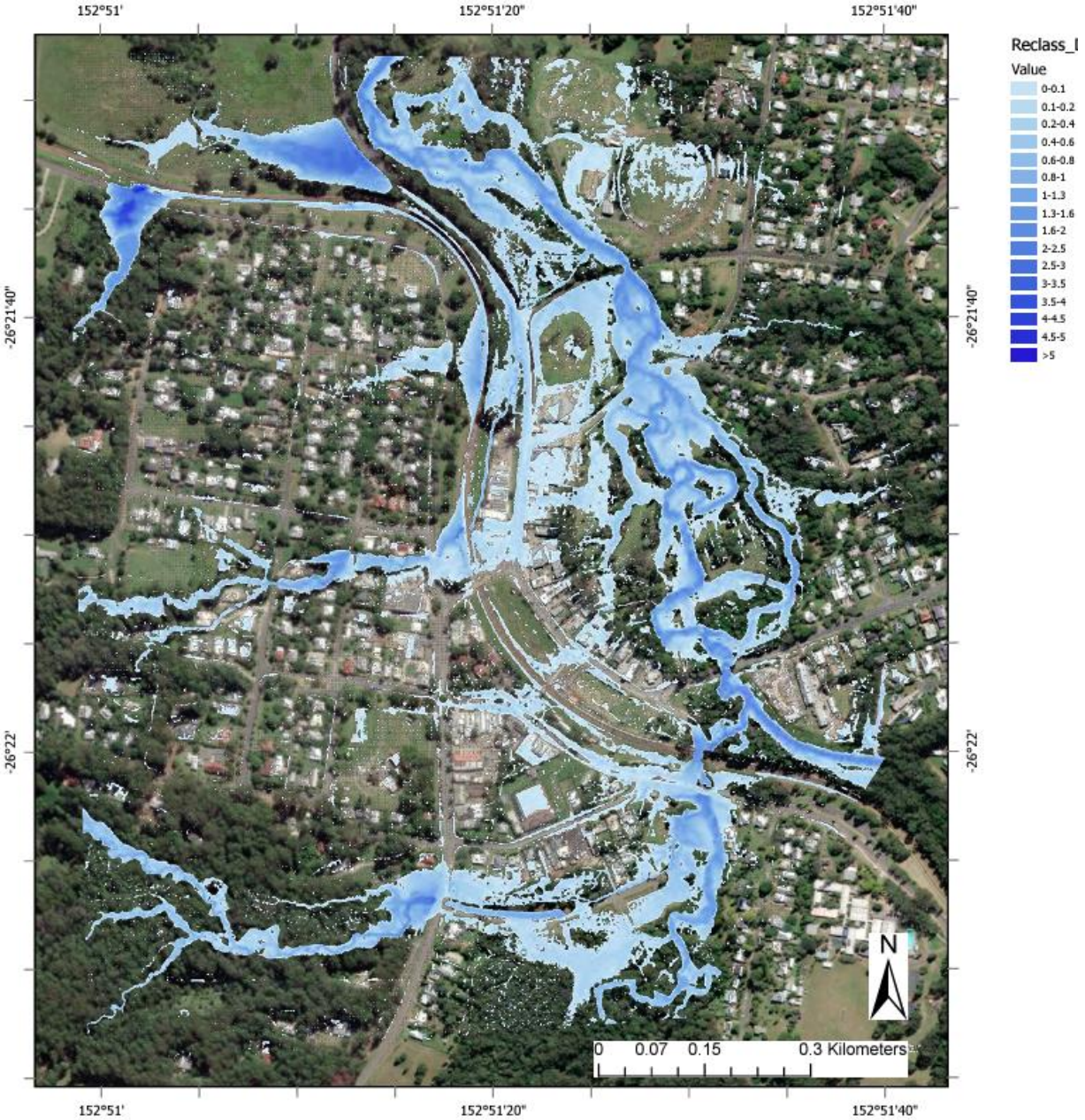
Pomona Sub-catchment

Pomona residential/commercial area vulnerable to flooding

Flood impacts

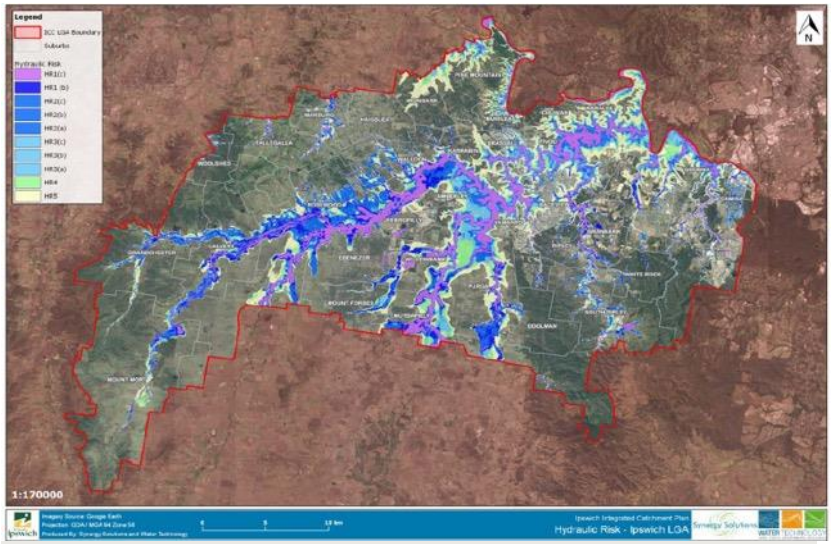
Dangerous water levels over roads
Inundation sewer pump station / overflow contamination
Isolation electrical substation
Local businesses and houses impacted





AEP 20% - Results (Leaky weirs reduce impacts)

Ipswich – Bremer Catchment

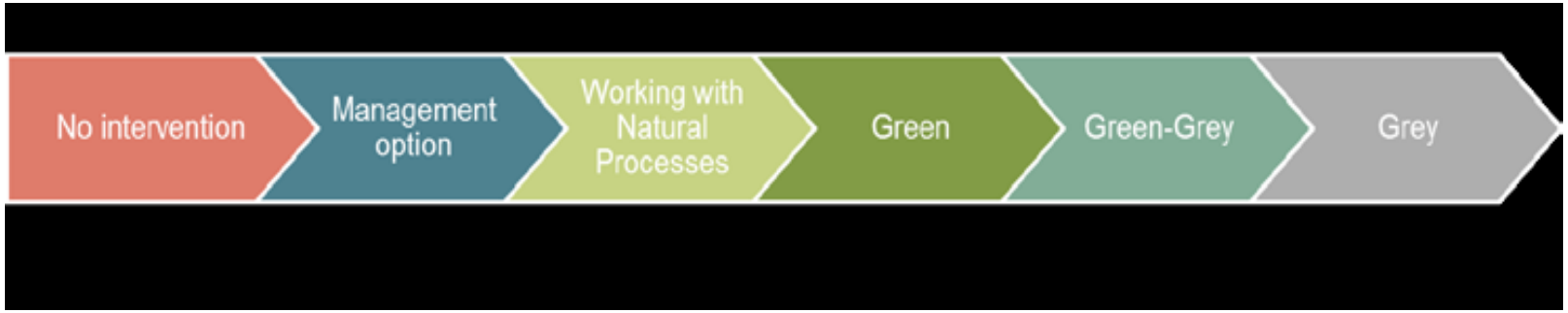


A “Spongy” Catchment approach enhances flood resilience combining -

:

1. Afforestation
2. Leaky weirs
3. In line wetlands
4. Revegetation of riparian zones
5. Urban Nature-based Solutions

Combining green and grey



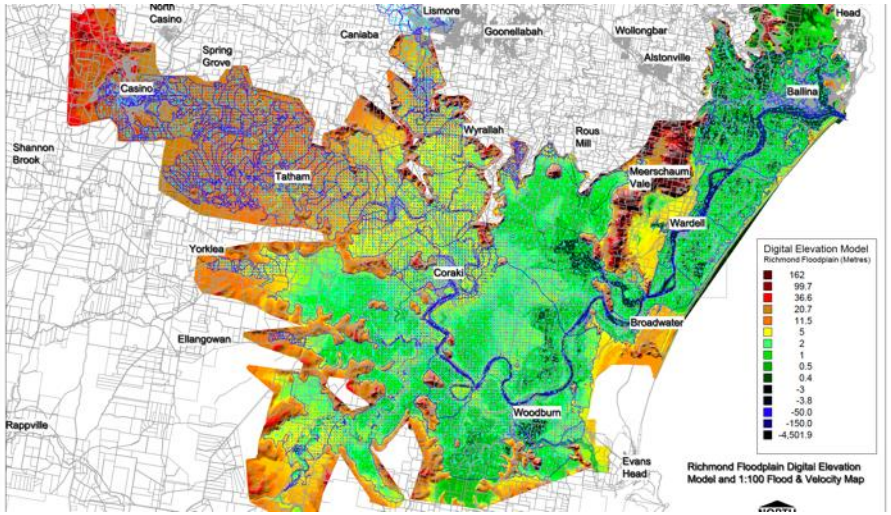
World Bank. 2017. *Implementing nature-based flood protection: Principles and implementation guidance*. Washington, DC: World Bank.

'No intervention' starting point.

1. Consider **management options**, e.g. early warning systems or land use planning.
2. Will **working with natural processes** achieve desired safety levels.
3. Is more **active intervention** necessary?
4. **Green-grey solutions** combine traditional infrastructure (levees/dams) with ecosystem restoration or other natural solutions.
5. If no other options available, select **traditional (grey) solutions**.

Integrated solutions to mitigate floods?

Integrated or ‘hybrid interventions’ leverage complementary strengths of both approaches to enable flood mitigation. Hybrid interventions may reduce high flood hazard areas to low hazard levels.

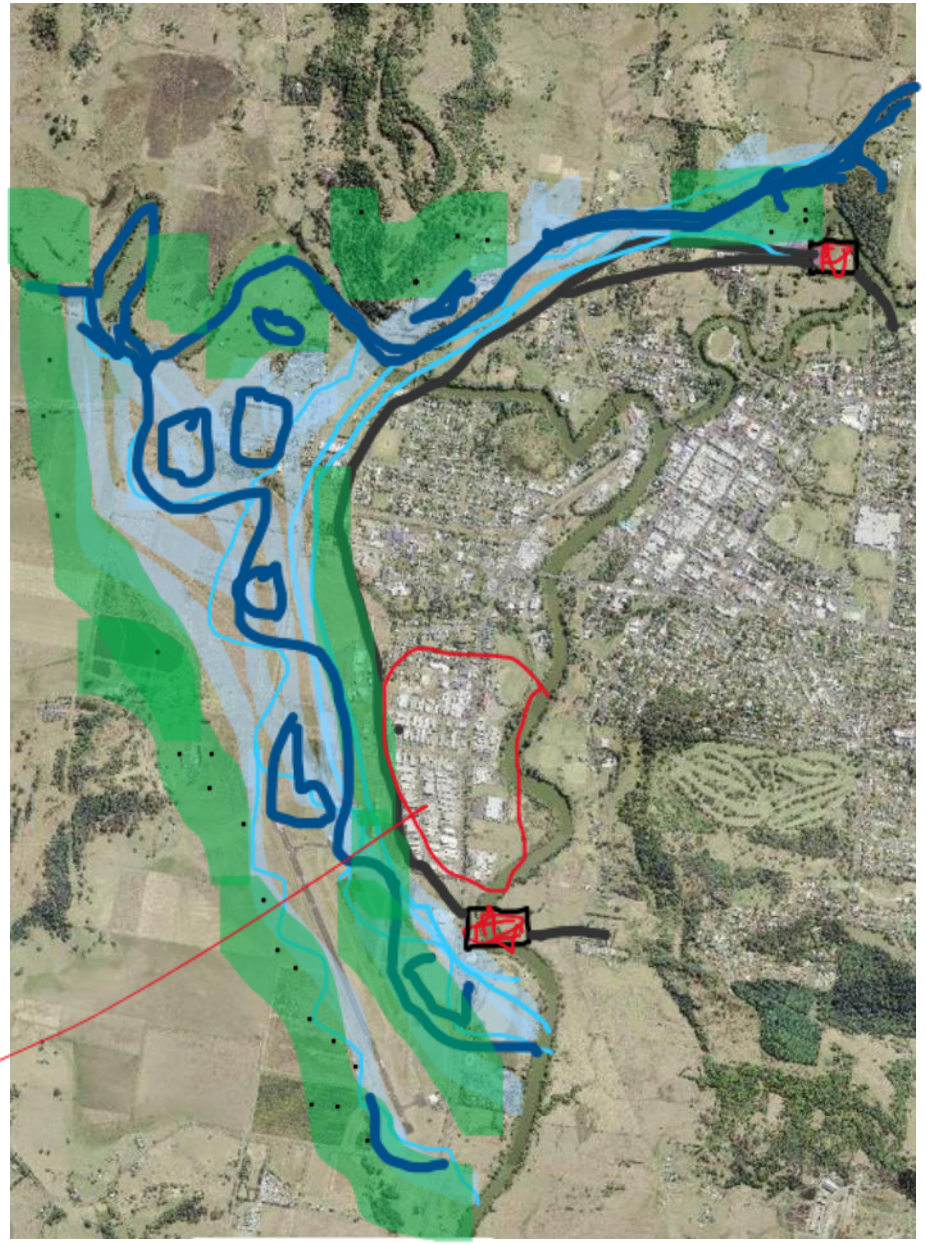


Lismore – diversion channel concept plan

Concept aligns with plans proposed by Italian Flood engineers from the Po River after the 1974 flood.

Paid for by Floriano Volpato, an Italian businessman and active community leader, who established the Continental Club in Lismore in 1962.

Their design for diversion channels were not implemented with devasting consequences in 2017 and 2022.
Note also industrial area expansion



NHRA Conserving and reconnecting floodplains project

Many collaborators
SEQ HLW and NHRA
3 years – just started
3 case studies
Bremer
Richmond

& ??????

Conserving and reconnecting floodplains offers social and economic co-benefits. Project focuses on;

- Understanding technical, policy and economic tools and techniques
- Conserving floodplains through appropriate planning
- Rehabilitation of existing but poor functioning floodplains
- Re-engagement of floodplains with their rivers.
- How catchments and floodplains interact

Floodplain conservation and restoration, represent an underutilised approach to flood risk mitigation. To advance flood management a comprehensive understanding of flood mitigation benefits and broader ecological and societal impacts is essential.

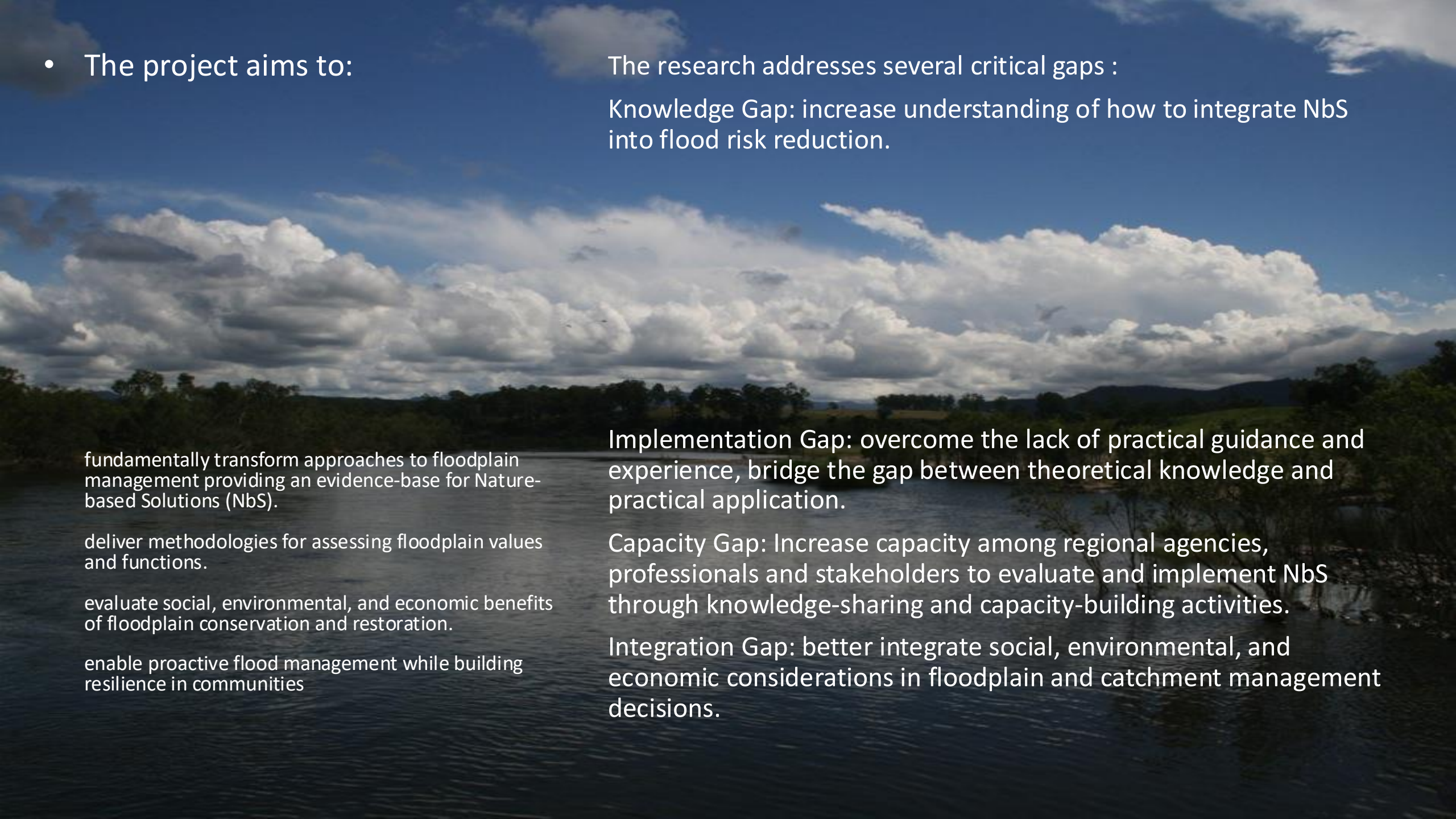
Research questions

- How do floodplain and catchment conservation and restoration measures (policy and physical interventions) affect flooding characteristics, including flood level, frequency, extent, and discharge peak attenuation?

Using case studies, the project will

- assess hydrological outcomes, economic of costs and benefits, social and environmental co-benefits.
- understand the institutional and community contexts that enable or hinder NBS adoption

- What are the economic effects of NbS implementation in terms of avoided flood costs, and how do these compare to traditional flood mitigation approaches?
- How can environmental and social co-benefits be assessed?
- What methods and analytical tools can be used to determine these?
- What policy mechanisms enable adoption of NbS?
- How can flood management frameworks better incorporate NbS?



- The project aims to:

fundamentally transform approaches to floodplain management providing an evidence-base for Nature-based Solutions (NbS).

deliver methodologies for assessing floodplain values and functions.

evaluate social, environmental, and economic benefits of floodplain conservation and restoration.

enable proactive flood management while building resilience in communities

The research addresses several critical gaps :

Knowledge Gap: increase understanding of how to integrate NbS into flood risk reduction.

Implementation Gap: overcome the lack of practical guidance and experience, bridge the gap between theoretical knowledge and practical application.

Capacity Gap: Increase capacity among regional agencies, professionals and stakeholders to evaluate and implement NbS through knowledge-sharing and capacity-building activities.

Integration Gap: better integrate social, environmental, and economic considerations in floodplain and catchment management decisions.

Nature Based Solutions

- Barriers

- Not mainstream
- Uncertainty
- Estimating cost-effectiveness
- Financial
- Governance
- Institutional
- Diverse stakeholder involvement

Conclusion 1: Aligning climate adaptation and disaster risk reduction.

There are strong rationales for integrating climate adaptation and disaster preparedness, - these are not separate fields of endeavour but part of a spectrum of preparing and planning for the future.

Climate change increases the risks of disasters.

We urgently need more integrated planning systems that span land use planning, disasters and community resilience.

We need more positive initiatives like nature-based solutions (NBS) and reforms that constrain inappropriate urban development in high-risk areas, like those prone to flooding, extreme bush fires or sea level rise.

Integrating adaptation and disaster preparedness is more than technical exercises. We must engage communities in the changing realities of climate-driven risk and empower positive decisions.

Overly centralised approaches are unlikely to succeed.

We need collective ways of learning and experimenting with innovative approaches that offer alternatives to traditional development models.

We must integrate big audacious goals – biodiversity conservation, community resilience and carbon sequestration – while protecting human settlements from a changing climate.

overcoming Australia's adaptation deficit

Australia needs a clear vision for a climate adaptive nation and ambitious plans to mobilise support for the reform agendas needed to achieve this vision.

We need to surface the powerful ideas on the policy and institutional reforms needed to empower adaptation.

A national adaptation reform agenda

Due to the "climate wars" Australia has an adaptation deficit.

To overcome this deficit, we need a national reform agenda to mobilise governments, industry and communities across the continent in exploring and executing diverse adaptation options. .

We need a coherent policy architecture and institutional reforms. Far-sighted and nationally coordinated reforms are needed that will work within the federation.

A reform agenda should be principles based and target diverse and interrelated policy domains, including land use planning, agriculture, water and natural resources, coastal policies, infrastructure, building and engineering standards, education and research, disaster preparation, transport and communications, and health and justice etc.

We need to explore appropriate institutional arrangements for planning, delivery and execution.

We must draw on our experience in cooperatively negotiating far-reaching reforms.

For example, through COAG all Australian governments adopted a principles-based water policy reforms in 1994 and again in 2004.

Like climate adaptation, responsibilities for water are dispersed across numerous and diverse policy, management, and regulatory agencies. Without a comprehensive, integrated, reform agenda, climate adaptation risks being driven through ad-hoc, reactive or crisis driven initiatives.

Thank you

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