Enhancing the resilience of seaports to a changing climate

Jane Mullett

Climate Change Adaptation Program, GCRI

- Darryn McEvoy, Sophie Millin, Helen Scott, Alexei Trundle (CCAP)
- Sujeeva Setunge, Tom Molyneaux, David Law, Kevin Zhang, Daniel Kong (SCECE)
- Prem Chhetri, Jonathan Corcoran, Victor Gekara, Brian Corbitt, Nilmini Wickramasinghe, Fatima Basic, Chris Maddox, Gaya Buddh Jayatilleke, Alex Manzoni (BITL)
The NCCARF plan for Settlements and Infrastructure identifies critical gaps in the information needed to address the full range of issues arising from the potential impacts of climate change on settlements and infrastructure.

Major infrastructure managers such as port authorities need to make decisions in advance of a tipping point being reached.
Objectives & Outputs

Objectives: Enhancing the resilience of seaports to a changing climate

- to gain a better understanding of the complex mix of climate and non-climate drivers that are likely to affect future port operations;
- to assess the vulnerability of core port infrastructure and identify appropriate adaptation measures for enhancing resilience;
- to assess the vulnerability of other elements at risk in the wider port environs and identify appropriate adaptation measures; and,
- to produce a synthesis report exploring the implications for policy and practice and produce an integrated decision support toolkit.

Outputs- reports: Preparing ports for the storm

- Synthesis of research and implications for policy & practice
- Climate change adaptation guidelines for ports
- Understanding future risks to ports in Australia
- Functional resilience of port environs in a changing climate – assets and operations
- Structural resilience of core port infrastructure in a changing climate

Relative density of global cargo shipping in 2007

Port case studies

Gladstone
- Bulk
  - Coal
  - Liquids
  - Minerals

Sydney
- Containers
- Liquids
- Mixed trade

Port Kembla
- Mixed
  - Agriculture
  - Liquids
  - Containers
  - Vehicles
    (RO/RO)
# Ports as systems

Potential climate impacts on different sub-components of the port system

<table>
<thead>
<tr>
<th>Navigation Berthing</th>
<th>Materials Handling (workforce)</th>
<th>Vehicles Movement</th>
<th>Goods Storage</th>
<th>Transport</th>
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<tr>
<td><strong>Climate impacts on physical infrastructure</strong></td>
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<td>Wave profiles</td>
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<td><strong>Climate impacts on functions</strong></td>
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<tr>
<td>Sea level rise</td>
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WP1: Understanding future risks

- Considering observed climate / weather data (BoM) and interpreting future climate projections (CSIRO)
- Considering extreme events (BoM, EMA, case study ports)
- Compilation of climate information packs for each of the case study ports
- Contextualising with non-climate drivers (population, trade, regulations, government policy).

Learnings

- The climate data is complex. A national approach to the expression of the data is needed
- The historical record is not adequate, the changing climate is dynamic – research into return periods of extreme events research is needed
- The planning cycle for trade is short-medium term (BREE), planning for adaptation is long term
- The national policy debate related to adaptation is still in the early stages (Ports Strategy, National Freight Strategy)

![Map of Australia showing temperature changes](image1)

- **much hotter + much drier**: CSIRO Mk 3.5 model
- **hotter + little change in rainfall**: MRI-CGCM2.3.2 model
- **hotter + much wetter**: MIROC3.2(hires) model

![Annual temperature pattern of change per degree of global warming](image2)

- Annual temperature pattern of change per degree of global warming (PDGW)
WP2: Functional resilience of port environs in a changing climate – assets and operations

- Created an integrated asset register for port infrastructure and functions
- Mapped the vulnerability of key functional assets to climatic hazards
- Modelled intra-port container flows and assessed future climate scenarios associated with extreme weather events
- Considered strategies that strengthen the adaptive capacity of the workforce; and accessed an integrated risk management framework to provide guidance for ports when developing tailored adaptation strategies.

Learnings
- Impacts are greatest on the supply chain, both hinterland and at sea, rather than at port
- Extreme events are already affecting ports and incremental adjustments are being made, mainly via OHS and Environmental Management systems and Emergency Response procedures.
- A well-functioning, proactive risk assessment and management system is a contributor to the adaptive capacity of a port and its workforce
- Management attitudes are important and training is needed – some ports have adaptation plans, but many do not.
WP3 Structural resilience of core port infrastructure in a changing climate

- Created an asset register of port infrastructure
- Assessed the port infrastructure materials vulnerable to climate change: concrete, timber, steel
- Forecast the rate of deterioration of structures over a period for which climate scientists could provide the necessary projections.
- Created a software tool which provides modelling of a number of deterioration mechanisms affecting port structures under different climate change scenarios

Learnings

- Ports are factoring sea level rise into new builds (up to 1 m)
- For existing concrete infrastructure, climate change can mean a significant reduction in time for a structure to reach a deterioration threshold
- There is likely to be increases in the frequency of maintenance required for concrete and wooden structures.
Take home message

- Ports need to work in partnership with other logistics providers and local/state/national governments
- The national port and freight strategies are at the beginning of the process – globalisation, supply chain and productivity issues all loom larger in the short term
- Communication of the climate science is still an issue, apart from sea level rise which is well understood
- There are many current opportunities to build in incremental adaptation
- Government regulation in regard to transparency around risk assessments and adaptation initiatives is important (UK example)
Next Steps

Climate Smart Seaports [beta]
Facilitating the identification and collection of relevant data so that Australian ports can become Climate Smart Seaports.

Information: BETA version
This is a BETA version of the tool that currently has data for three RIM regions. Please refer to the limitations section of the Guidance document for further process and data limitations.

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The Climate Smart Seaports Tool enables interested users to begin the process of a climate risk assessment. It assists them to identify current and historical climate trends and variability, as well as future climate projections under a variety of scenarios.

Population and trade data is included, and users can add port-specific information to round out their analysis.

Adapting to climate change is still in its infancy and all organisations are learning how to manage the risks posed by the changing climate. One way to learn is by communication. One of the aims of this tool is that users will publish their generated reports to the Climate Smart Seaports site, promoting peer-to-peer learning and the spread of knowledge.

Often risk management is confined to specific areas of a business operation, e.g. risks related to trade, to supply chains to the workplace functions or infrastructure. However, climate change poses a risk to all areas of a business. This tool attempts to bring the thinking about climate risks in different areas of the business into one report, beginning the creation of an integrated climate risk assessment.

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