Evaluating mining industry options for adapting to climate extremes

Supriya Mathew, Ros Taplin, Brendan Fox, Ann Henderson-Sellers, Stefan Trueck and Tim Keighley

*NCCARF Climate Adaptation Conference 2014*
Extreme events and the mining industry

• **Significant impacts** on the Australian mining industry (e.g. Qld floods 2007-2008; 2010-2011)
  - Qld floods 2010-2011 (QFCI 2012)
    - loss of $5.7b to Qld gross state product + reduction in royalties
    - 85% of Qld coal mines restricted operations or closed entirely
    - Significant environmental and social consequences

• **Current approach** to extreme event preparation
  - Designs based on historical observations of events
    - e.g. 1 in 100 year event
  - Insurance against damages
    - Reactive approach than precautionary approach
    - More focus on dollars

• **Alternative approach** to extreme event prep.
  - Based on recent trends/potential risks
  - Consideration of non economic future damage for decisions

Switch btw dry & wet season
Annual targets; high rates of staff turnover
Uncertainty in event occurrences
Absence of localised projections
Absence of proper guidance/tools (Sharma *et al.* 2013; Mason & Giurco 2013)
Climate Adaptation Tool for Local Governments: CATLog decision-making tool

- **Risk analysis**
  - Frequency distribution
    - Expert view and historical data *(Observations are limited)*
  - Severity
    - Expert view based on data
  - Simulation of extreme weather *(Lognormal, Weibull, Burr distribution)*
  - Sensitivity analysis
    - Vary freq., severity, discount rate, growth rate, sev. distribution, time horizon

- **Risk reduction: Adaptation prioritization**
  - Cost Benefit Analysis *(Quantitative assessment)*
    - Net benefit in $s as evaluation criterion
    - Sensitivity tests: freq, severity, discount rate, growth rate, time horizon
  - Multi-Criteria Analysis
    - Multiple evaluation criteria *(Qualitative assessment)*
    - Sensitivity tests: change expert opinion weighting, criteria weighting
Coal production & rainfall 1992-2012
Bowen Basin, Qld

- Monthly production
- Exponential trend

Qld Dept. of Natural Resources & Mines 2013

7.45% growth rate
0.49% growth rate

Rainfall (mm)

1992-2002

2003-2012

Historical
1993-2002
Emerald station
BoM 2013

Historical
2003-2012
Adjust for non flood related factors

• Predicted trend

Adjust production for
• increases in annual production over time
• monthly variations in production

• Wet season losses beyond predicted trend

Difference between actual production and ‘predicted trend’ used to determine impact of identified events.
Flood event analysis

<table>
<thead>
<tr>
<th>Extreme weather scenario</th>
<th>Description</th>
<th>Data based on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>Historical</td>
<td>1993 to 2002</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>All data</td>
<td>1993 to 2012</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>Recent trends</td>
<td>2003 to 2012</td>
</tr>
<tr>
<td>Scenario 4</td>
<td>Projection 1: Recent decade + 5%</td>
<td>2003 to 2012 + 5%</td>
</tr>
<tr>
<td>Scenario 5</td>
<td>Projection 2: Recent decade + 10%</td>
<td>2003 to 2012 + 10%</td>
</tr>
</tbody>
</table>

To be used as input to CATLoG tool for loss distribution
CATLoG – exposure assessment

Example scenario test results – 10 Mt/annum operation with a 20 year mine life for 10,000 simulations under extreme weather scenarios

Simulated loss distribution using CATLog

CATLoG estimates of regional economic exposure over 20 years
Different investment options

- Evaluation of options with a range of costs and benefits
- Assessed for economic viability and to compare various options’ economic benefit.
CATLoG multi-criteria assessment

- Multiple evaluation criteria (i.e. can include non economic evaluation criteria)
  - Less tangible social, environmental costs and benefits (e.g. damage to ecosystems, local community impacts)
  - Vary criteria weightings & expert weightings

**Criteria scores for investment options**

**Ranking investment options**

- **Economic**
- **Environmental**
- **Social**
Exposure of Bowen Basin coal mines in Central Queensland to flooding

• Recent events have intensified the **mining industry focus on flood management** in the Bowen Basin.

• **With current standards of infrastructure and design:**
  - **1.5-2.5% of annual production** is projected to be lost in the long-term due to flooding events.
  - **Severe events** could see approximately **7% of production lost in any given year.**

• **Ensham and Baralaba mines** have each constructed flood levee infrastructure designed for a **1-in-1000 year event** after incurring severe losses from the flooding events.

• **Such adaptation strategies are not expected to build complete resilience to flooding events but can reduce the extent of negative impacts.**
Contacts

• Dr Supriya Mathew: supriya.mathew@cdu.edu.au
• Professor Stefan Trueck: stefan.trueck@mq.edu.au
• Professor Ros Taplin: r.taplin@unsw.edu.au