Risks, Resilience and Resource Management

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Overview

1. Responding to Risks
2. Risk Management with Derivatives
   (a) Environmental derivatives
   (b) Climate derivatives
3. Resilience Management Tools:
   (a) MPAs and capacity & robustness resilience
   (b) Groundwater depth & robustness resilience
   (d) Networks, offsets & ‘speed of recovery’ resilience
4. Conclusions
1. Responding to Risks
## Risk: Probability X Consequences

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Consequence Level</th>
<th>High</th>
<th>High</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost certain</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible</td>
<td>MINIMAL</td>
<td>MINIMAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlikely</td>
<td>MINIMAL</td>
<td>MINIMAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rare</td>
<td>MINIMAL</td>
<td>MINIMAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insignificant</td>
<td>Minor</td>
<td>Moderate</td>
<td>Major</td>
<td>Catastrophic</td>
</tr>
</tbody>
</table>
Exposures, Sensitivities, Actions and Consequences

- **Exposures**
  - High
- **Sensitivities**
  - High
- **Potentials**
  - Consequences
- **Actions**
- **Mitigated Consequences**
Causal Risk

THREATS

TRIGGERS

RISK EVENTS

CONSEQUENCES

Pre-trigger Controls

Controls

Mitigants
Causal Risk and Resilience

Before the Trigger  |  Trigger  |  Consequences

System Performance

PRE-TRIGGER CONTROLS

TRIGGER CONTROLS

Uncertain Sensitivities

Resilient

MITIGANTS

Vulnerable

Time
2. Risk Management with Derivatives
Environmental Derivatives

Spawnning biomass trajectory

Source: Little et al. (2013)
Pricing Risk

![Diagram showing risk and pricing](image)
Climate Derivatives

FINANCED CLIMATE ADAPTATION

PRESENT TRANSACTION

**Seller:** receives payment from investor, which is used to invest in adaptation strategies to warmer temperature.

**Investor:** pays the seller, in the expectation of receiving a payoff if increasing temperatures fail to eventuate.

LIFETIME OF CONTRACT

OUTCOMES AT MATURITY

**Temperature Index > Strike Value**

**Seller:** no payout is required, with original payments used to invest in adaptation strategies.

**Temperature Index < Strike Value**

**Seller:** pays out to **Investor,** but the cost is offset by the benefit of a temperature below the strike value.
Climate Derivative Prices

Source: Little at al. (2015)
3. Resilience & Resource Management
Capacity, Robustness & Rapidity Resilience

Adapted from Linneluecke and Griffiths (2010)
(1) MPAs: Capacity & Robustness Resilience

Source: Grafton et al. (2009)
(2) Groundwater Depth: Robustness Resilience

Source: Katic and Grafton (2011)
Speed of Recovery Resilience-Return Tradeoffs

Source: Katic and Grafton (2011)
(3) Metapopulations, Networks & Offsets

Source: Little and Grafton (2015)
Iso-resilience and Conservation Offsets

Source: Little and Grafton (2015)
4. Conclusions

1. Risk analysis (likelihood X consequences) has serious weaknesses. Causal risk analysis offers a valuable alternative with focus on threats triggers and actions.

2. Derivatives (for environment & climate) offer new approaches for managers and resource users to transfer risk. Option prices give valuable information about risk and changes in risk.

3. Multiple management tools can be used to support specified resilience (robustness, capacity & speed of recovery) resilience. Different approaches (MPAs, well-groundwater depth control, offsets) offer potentially win-win outcomes (greater resilience and higher net returns to resource users).
References and Sources


