

Interactive impact assessment



Manaaki Whenua
Landcare Research

*Supporting coastal adaptation to
climate change using serious games*

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NZAIA 2019, 29 November



PCE, 2015

<https://www.pce.parliament.nz/media/1390/preparing-nz-for-rising-seas-web-small.pdf>

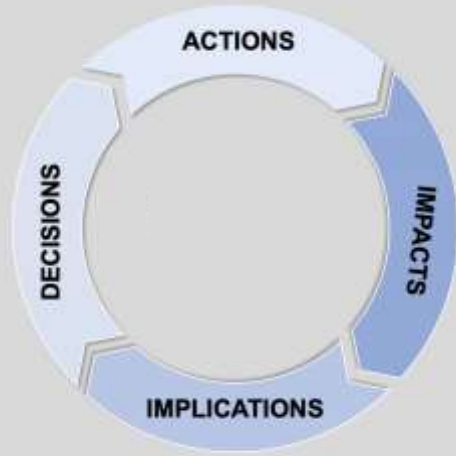
MfE, 2017.

<https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/coastal-hazards-summary.pdf>



Climate change affecting coastal regions

- Communities starting to feel impacts...
 - SLR, storm surge, erosion and flooding
- Increasing impacts over time
- Range of adaptation options
- Limited community knowledge of alternatives and the limits to each
- Multiple possible combinations over time (pathways)
- Deeply-held values, vested interests, highly contested
- Hard to conceive the scope of the problem
 - Ambiguity, uncertainty, ignorance (Stirling, 2010)



Requires different knowledge

- Direct **impacts** of climate change on the natural or linked natural-human environment.
- Effects and management **implications** of specific impacts for human-environment systems, including insurance, infrastructure and habitability.
- Information to support decision making, identifying when, where and what **decisions** need to be made.
- Accelerate **action** towards long-term sustainability through changes in behaviour and implementation



Assist with navigating adaptation issues and support long-term decision making?

Flood et al., 2018
<https://doi.org/10.1088/1748-9326/aac1c6>

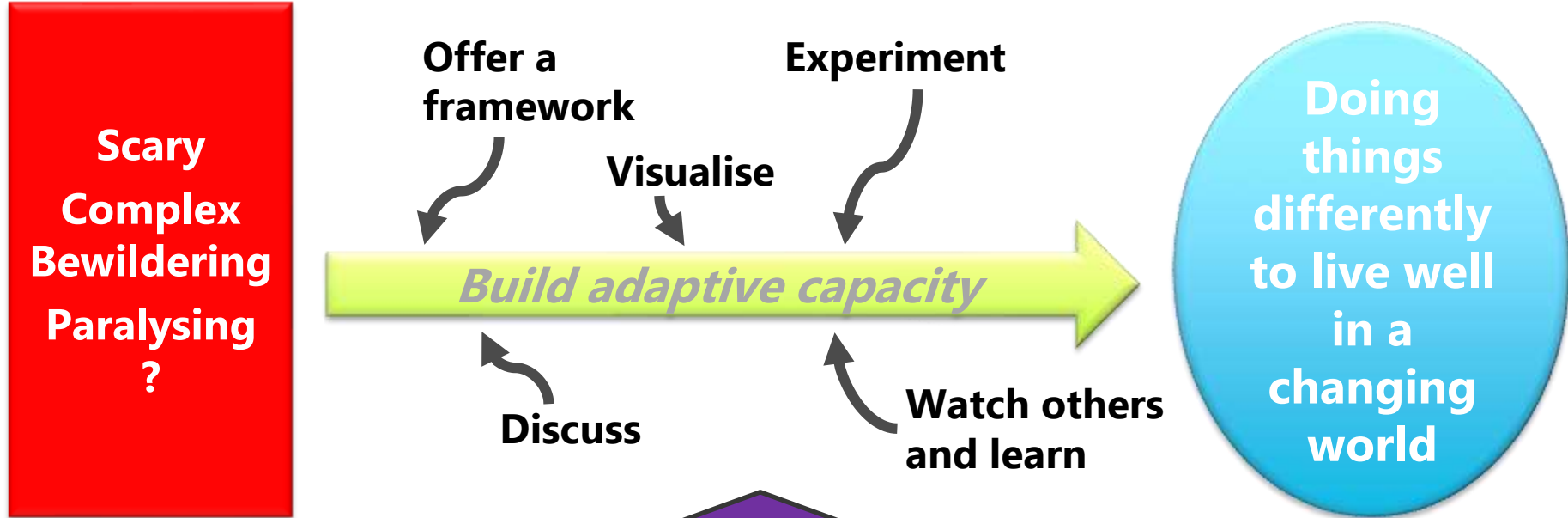
Edwards et al., 2019
<https://doi.org/10.1088%2F1748-9326%2Fab4036>

Serious Games

- ‘Serious games’— games used for purposes other than entertainment— can provide opportunities for social learning and enabling positive action (Flood et al., 2018)
- Role playing games (RPGs) allow players to reflect on values, rules, knowledge (Edwards et al., 2019)
- Communicate complex concepts and encourage experimentation in a ‘safe’ environment
- Build capability and capacity for finding solutions
- Facilitates conversations



Leverage the imagination for adaptation



Games

Strategy – Choice - Trade offs - Consequences

- Player's role as decision maker (Edwards et al. 2019)
- SLR is causing inundation and coastal erosion.
- Rate of change is unknown (MfE, 2017).
- The player must work with the community
 - Build trust
 - Short-/long-term
- Decisions in 10-year blocks (100 years)
- Decisions have consequences.



Adaptive Futures

Seaview 2019

Community Stakeholders

The beach is OK!
 The park is OK!
 The road is OK!
 The central shops are OK!
 The roadfront houses are OK!
 The motel and backstreet shops are OK!
 The main residential areas are OK!

Make some decisions



Non-Player Characters



How the player engages with each character and the adaptation options applied influences the characters' subsequent behaviour.

	Reactive	Adaptive
Trust	Outrage	Lethargic
	Satisfaction	

Satisfaction

- + when proposed adaptations are adopted
- when negative effects of climate change are experienced.

Trust

- + when player consults with characters
- when alternative proposed adaptations are adopted.

Sample responses

Outraged Kim

"My customers are getting turned off from these storms we keep getting! My business is vital to this community!

What's the use of this committee if they can't keep the beach from washing away?!"



Adaptive Kim

"The last event really took a toll on my business. There is only so much I can do as one small business owner to ensure that we are planning ahead for sea level rise. **I want to work together with others** to develop a sound financial plan for the future of our community."



- Two key impacts: **inundation** and **coastal erosion**.
- Drawn from MfE (2017) Guidance for Local Gov't.
- Function of Representative Concentration Pathway (RCP)
- Damage determined by frequency of storms in a 10-year period, generated using probability model linked with realistic occurrences.



Impacts

NZ SLR scenario Year	NZ RCP2.6 M (median) [m]	NZ RCP4.5 M (median) [m]	NZ RCP8.5 M (median) [m]	NZ RCP8.5 H* (83rd percentile) [m]
1986–2005	0	0	0	0
2020	0.08	0.08	0.09	0.11
2030	0.13	0.13	0.15	0.18
2040	0.18	0.19	0.21	0.27
2050	0.23	0.24	0.28	0.37
2060	0.27	0.30	0.36	0.48
2070	0.32	0.36	0.45	0.61
2080	0.37	0.42	0.55	0.75
2090	0.42	0.49	0.67	0.90
2100	0.46	0.55	0.79	1.05
2110	0.51	0.61	0.93	1.20
2120	0.55	0.67	1.06	1.36
2130	0.60*	0.74*	1.18*	1.52
2140	0.65*	0.81*	1.29*	1.69
2150	0.69*	0.88*	1.41*	1.88

Decadal increments for SLR projections relative to baseline

MfE, 2017.

Adaptation options

- Life span linked w/SL
- Options fails as limits approached
- Options have financial costs

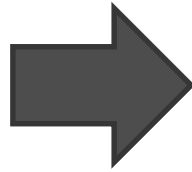


Sea wall (1 and 2)



Retreat (1 and 2)

Do nothing

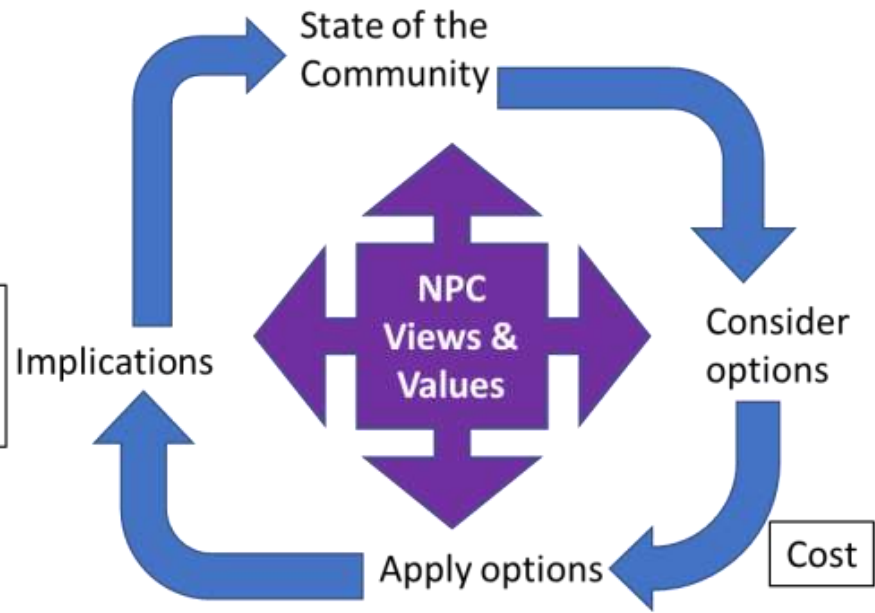


How the game works

Adaptive Futures

Year: 2029
Sea level: +0.11 m
Budget: \$180 k
Approval Rating: 22%

Emission Scenario
Storm events
Existing adaptation



Adaptive Futures

Year: 2019
Sea level: +0 m
Budget: \$100 k
Approval Rating: 33%

SAVE
RESTART

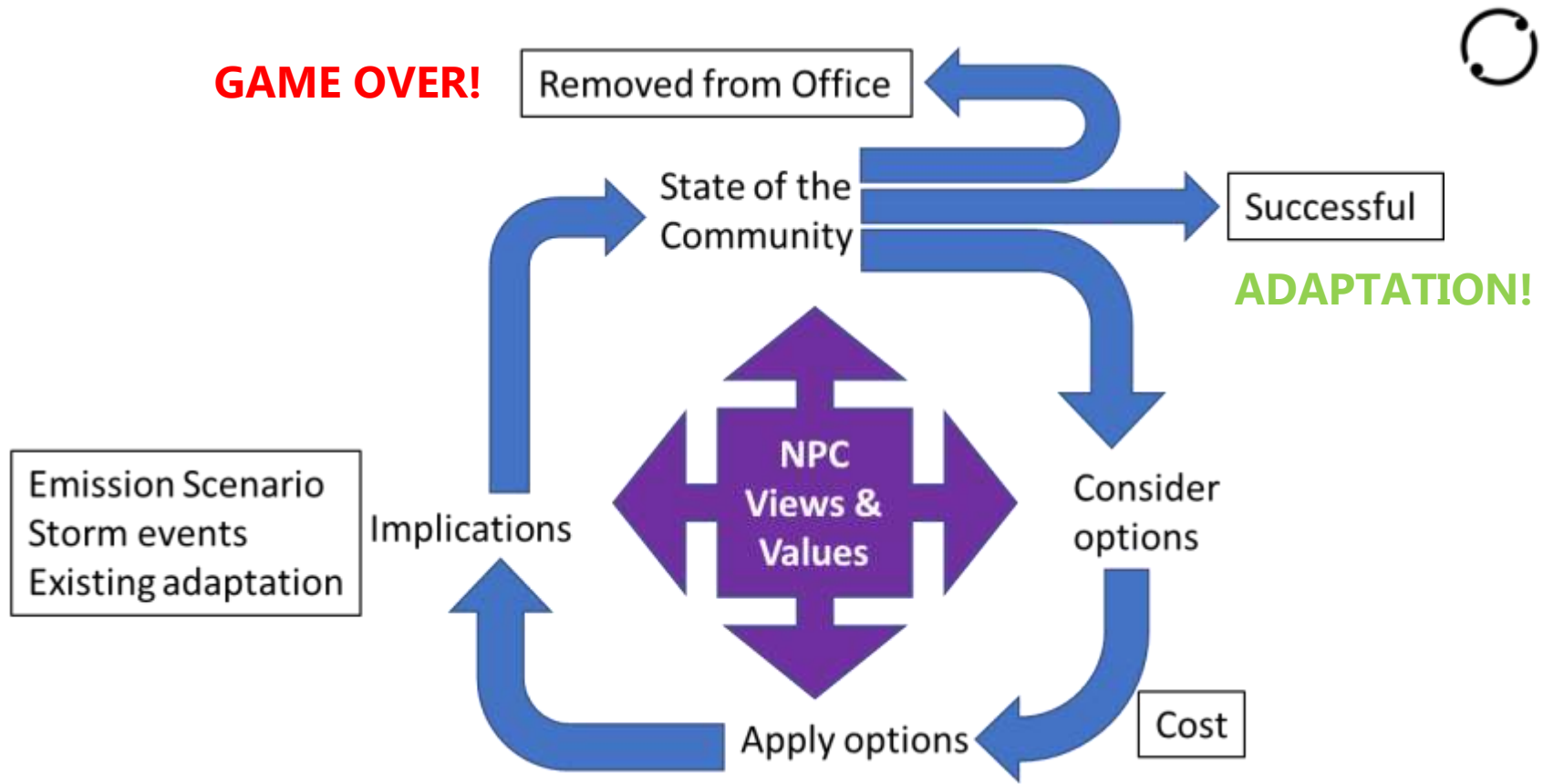
Seaview 2019

Community Stakeholders

Make some decisions

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How the game works

Game evaluation and conclusions

- Overwhelmingly positive response
- Highly engaging
- Evidence of learning (normative, relational, cognitive)
 - Options
 - View of different stakeholders
 - Complexity
- Games advance the conversation from paralysis to thinking about how we can respond strategically.
- Enable exploration and consideration of impacts, implications, decisions and actions that may be required.



Cradock-Henry, N.A., Buelow, F., Flood, S., Blackett, P., Wreford, A., 2019. Towards a heuristic for assessing adaptation knowledge: impacts, implications, decisions and actions. *Environ. Res. Lett.* 14, 093002. <https://doi.org/10.1088/1748-9326/ab370c>

Edwards, P., Sharma-Wallace, L., Wreford, A., Holt, L., Cradock-Henry, N.A., Flood, S., Velarde, S.J., 2019. Tools for adaptive governance for complex social-ecological systems: a review of role-playing-games as serious games at the community-policy interface. *Environ. Res. Lett.* 14, 113002. <https://doi.org/10.1088/1748-9326/ab4036>

Flood, S., Cradock-Henry, N.A., Blackett, P., Edwards, P., 2018. Adaptive and interactive climate futures: systematic review of 'serious games' for engagement and decision-making. *Environ. Res. Lett.* 13, 063005. <https://doi.org/10.1088/1748-9326/aac1c6>

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Parliamentary Commission for the Environment, 2015. Preparing New Zealand for rising seas: certainty and uncertainty. PCE, Wellington.

Stirling, A., 2010. Keep it complex. *Nature* 468, 1029–1031. <https://doi.org/10.1038/4681029a>

Thank you



Game play at:

<https://bit.ly/2DiSkmL>



National
SCIENCE
Challenges

RESILIENCE
TO NATURE'S
CHALLENGES

Kia manawarua
– Ngā Aina o
Te Ao Tūroa