Coastal Case Study: Introduction

Graham McBride, NIWA, Hamilton

Landcare Research Manaaki Whenua
NIWA Taihoro Nukurangi
agresearch
Bodeker Scientific
Motu Economic and Public Policy Research
Plant & Food RESEARCH Rangahau Ahumara Kai
SCION forests · products · innovation
Te Whare Wānanga o te Ūpoko o te Ika a Māui VICTORIA University of Wellington
PSConsulting Ltd
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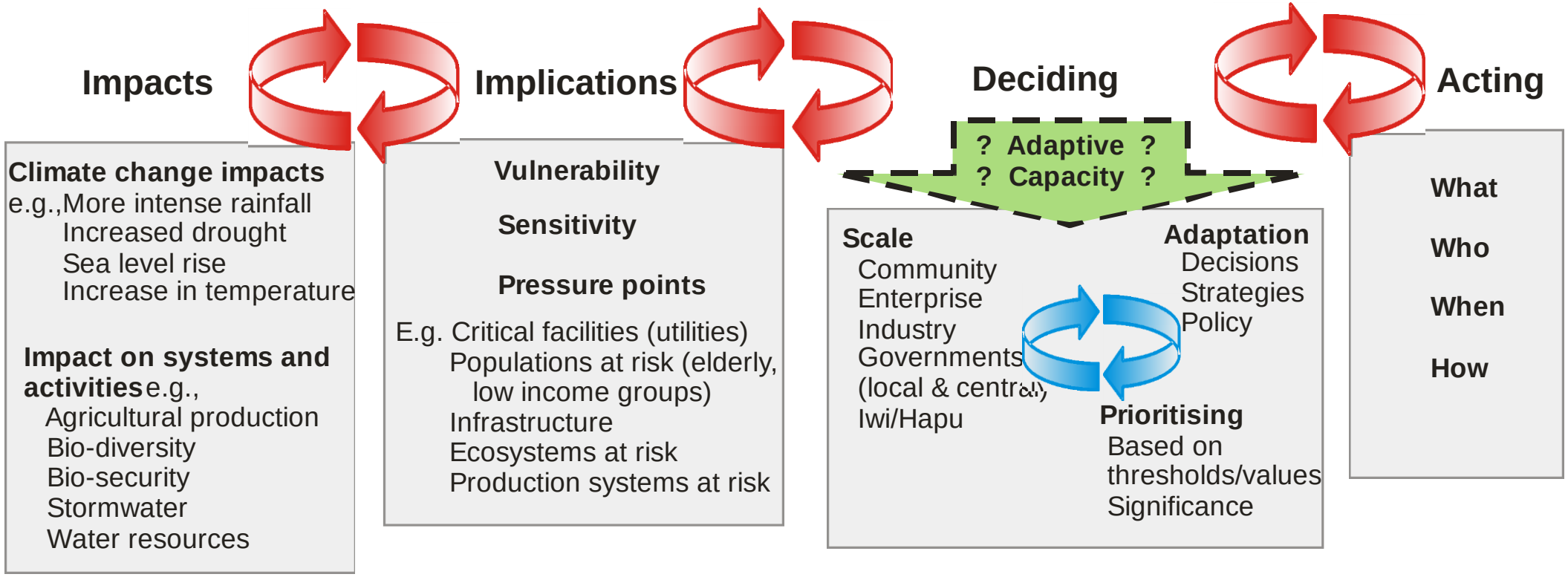
Research Aim 2: Case studies

- “Understanding Pressure Points, Critical Steps, and Potential Responses”
- Five case studies: Alpine, Uplands, Lowlands, Coastal, Marine
  - Based on modelling, not field work surveys and experiments, so draw on other studies’ data
  - Coverage not contiguous
- Modelling:
  - A cheap imitation of the real thing
  - Makes projections (to 2100), not predictions
  - “All models are wrong, some are useful” (attributed to George Box)
  - Can sometimes make as much (or even more!) progress with a simple model (e.g., water column model versus 3D system, as we shall demonstrate)
  - Models identify *impacts* under particular scenarios (RCP, social/economic policy)
  - *Implications* also rely on other scenarios and likely/desirable changes to public policy

Impacts and implications, and beyond



Understanding

Adaptation

Impacts considered, after liaison with stakeholders (December 2013, May 2014)

- A long list (don't read it all!)

  Ground-water salinization of coastal aquifers; changes in tidal range; enhanced upstream saline intrusion affecting potability of water supplies and suitability for irrigation; changes in estuarine ecosystems (e.g., through drowning of intertidal reefs); changing temperature and aquatic plant habitat effects on kaimoana; changes in estuarine sedimentation and consequent effects on ecosystem health; changing underwater light regimes; impacts on ICOLLs (Intermittently Closed and Open Lakes and Lagoon) and river mouths; land drainage and stormwater management in low-lying land; shoreline erosion; microbial water quality changes affecting public health; drainage and stormwater systems; bank erosion; river flood control measures (e.g., willow management, outflanked by sea level rise); changing effect on river cuts or partial diversions, bridges & road/rail infrastructure.

Site selection?

- Criteria
  - Include SLR (only case study to do so—of course)
  - Include *hazards* and *habitats*
- So base studies on Waihou River (flooding and saline intrusion), Firth of Thames sedimentation (how will water depth change with time?)
- Model four RCPs (Representative Concentration Pathways, reflecting increased radiative forcing), six RCMs (Regional Climate Models), and different policy settings (e.g., for landuse evolution)
  - That's a lot!

Models used

- *Hazards*
  - TELEMAC 3-D for hydrodynamics and saline intrusion (freeware, excellent support)
    - ✓ Must be 3D (for saline intrusion at least), because 2D models produce nonsense for stratified flows
    - ✓ Voluminous output, so need to summarise succinctly
- *Habitats*
  - Original intention was to run 3D (Delft, i.e., Deltares) model for two idealised Hauraki Gulf estuaries plus the Firth of Thames.
    - ✓ Need a quantum computer to run many scenarios (six RCMs, four RCPs, three social policy settings) for 100 years in 3D using tiny timesteps
    - ✓ So have modelled the Firth only, using a newly-developed simplified water column sedimentation model coupled with a few particular runs of the 3D model with different wind conditions

Results

- *Hazards*
  - Glen Reeve will address Waihou River flooding and salinity intrusion, identifying impacts and implications
- *Habitats*
  - Mark Pritchard will address Firth sedimentation modelling
  - Graham McBride (standing in for Carolyn Lundquist) will address impacts on mangrove habitat, also identifying impacts and implications