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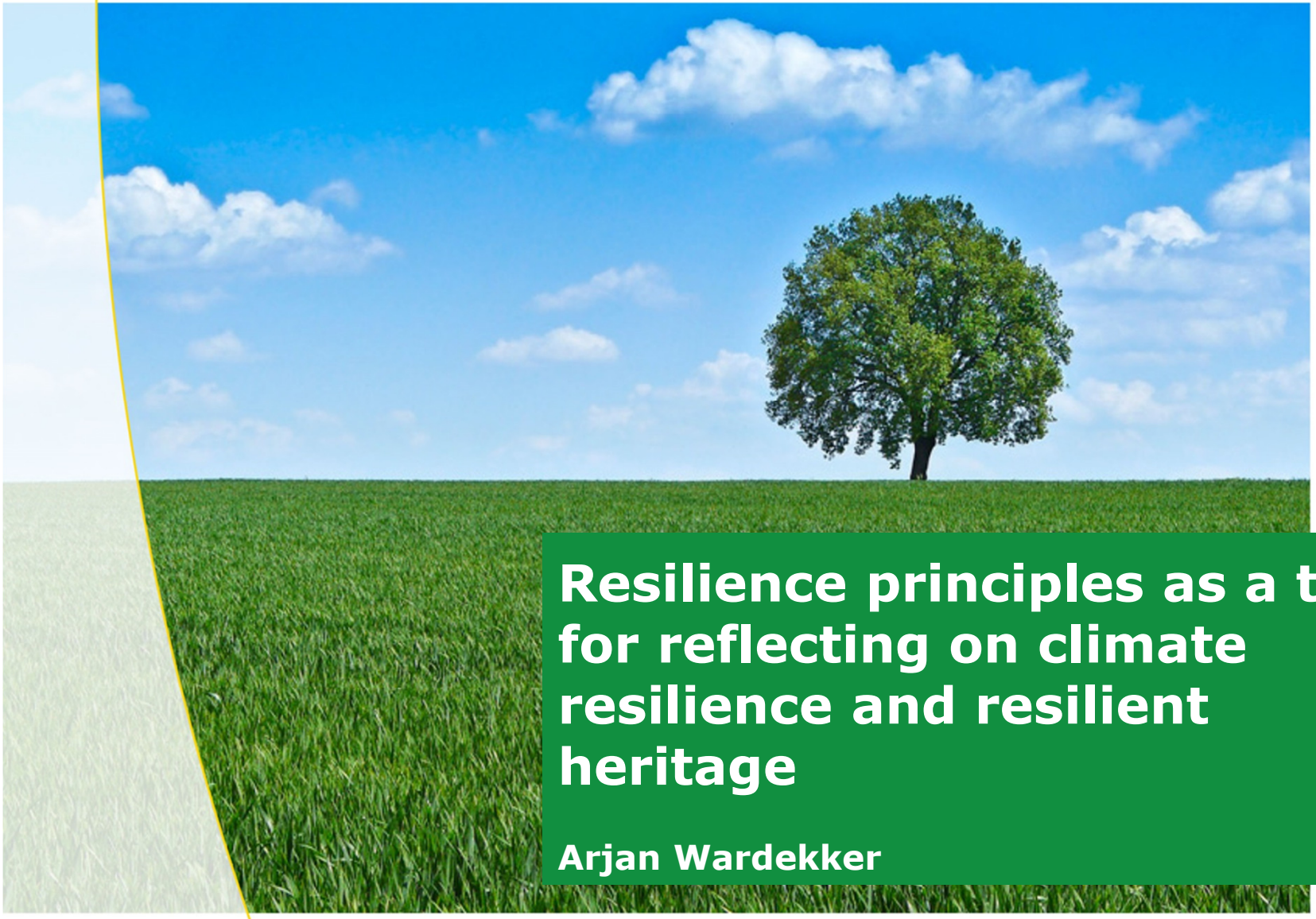

Resilience principles as a tool for reflecting on climate resilience and resilient heritage

Arjan Wardekker

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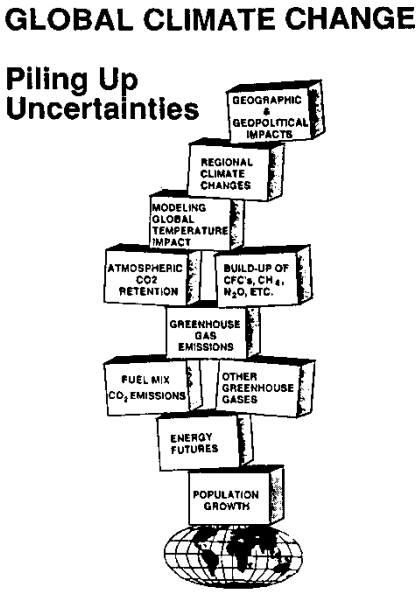
Resilience principles…

- … what's that?
- … as tool to *generate* adaptation options & plans
- … as tool to *evaluate* adaptation options & plans

- Diagnostic Tool development (work in progress)

Resilience



'Predict & prevent'

'Resilience & coping with change'

Resilience

- "the capacity of a system to **absorb** disturbance and **reorganize** while undergoing **change** so as to still retain essentially the same function, structure, identity, and feedbacks" (Walker et al., 2004)

- Ambiguous concept?
- Influence of framing?

(Wardekker, 2016; Wardekker et al., 2009; De Boer et al., 2010)

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Resilience principles

(classic generic set)

Principle	Aspects
Buffering	Absorb
Redundancy	Absorb
Omnivory	Absorb, reorganise
Flatness	Quick response, recover, reorganise
High flux	Quick response, recover, reorganise, change
Homeostasis	Quick response, self-organisation, learning & change

(Watt & Craig 1986; Barnett, 2001; Wardekker, 2011; Wardekker et al., 2010, 2016)

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Resilience principles

(detailed set, specific for diagnosing urban climate resilience)

Category	Principle	Operationalisation	Indicators
Foresight & preparedness	Anticipation & Foresight	Building knowledge about disturbance, exposure, vulnerability	**Etc. …**
		Monitoring of critical slow variables	
		Information management & sharing	
		Capacity to learn (from past experience)	
	Preparedness & Planning	Public awareness, risk communication, education & training	
		Response & emergency management	
		Preparedness of business for adverse events	
	Homeostasis	Preservation of regulating ecosystem services	
		Integrated planning, coordination & collaboration	
		Clearly defined responsibilities of actors & institutions	
		Entrenching flood-proofing in national law	
		Inclusiveness & equity standards	
		Quick notification of disturbances	
Absorbing disturbances	Robustness & Buffering	**Etc. …**	
	Diversity		
	Redundancy		
Recovering from disturbances	Flatness		
	High-flux		
Adaptability & change	Learning		
	Flexibility		

(Wilk, forthcoming; Wardekker et al., forthcoming)

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Generating options
(example: cultural heritage at different scales)

Scale: **Principle:**	***Building***	***City/town***	***Landscape***
Buffering	Rain barrels	Water squares, wadi's	River overflow areas
Omnivory	Indoor & outdoor activities	Variety of possible transport modes	Economy / revenue model is varied, not dependent on one source of income
Homeostasis	Sensor/app alerts caretaker about extreme weather	Sandbags are available locally in flood-prone areas	Automated sluices, etc. respond to changing conditions

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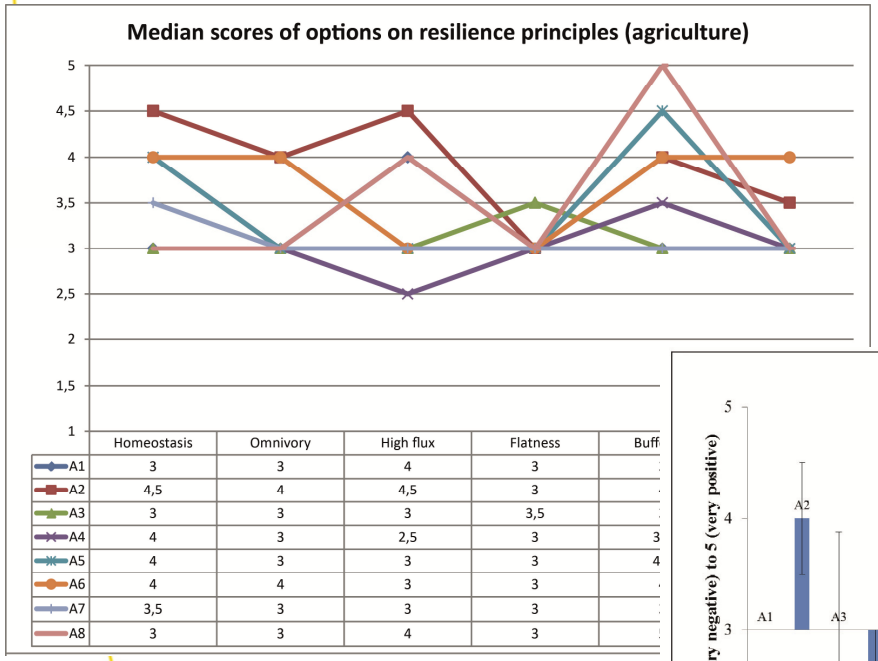
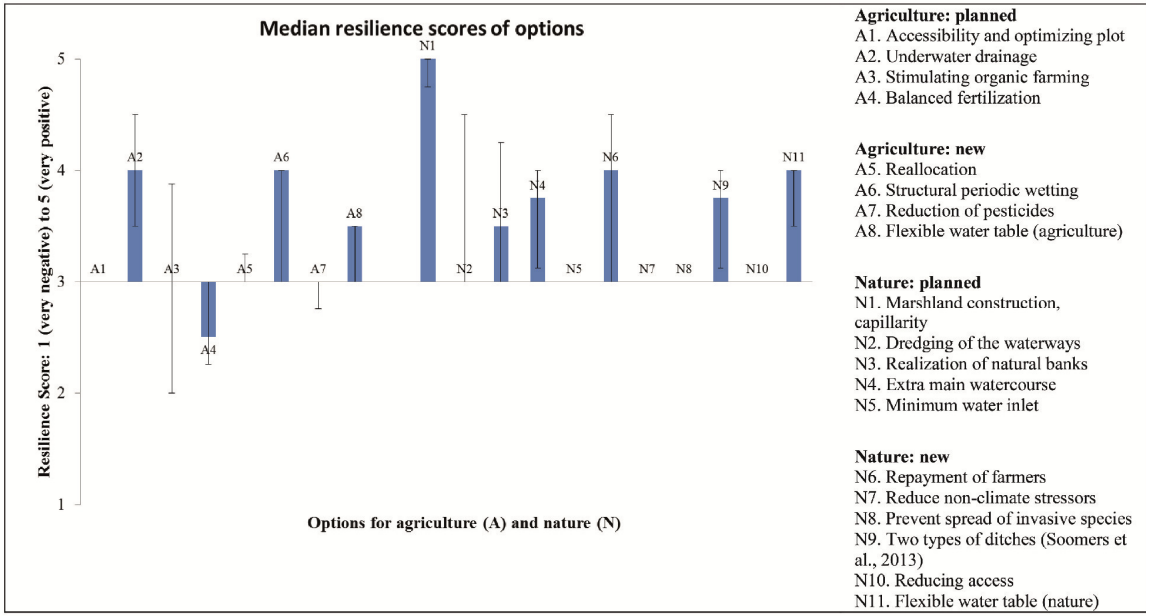
Evaluating options
(example: Dutch polder peat-meadows)



	Homeostasis	Omnivory	High flux	Flatness	Buff
A1	3	3	4	3	
A2	4,5	4	4,5	3	
A3	3	3	3	3,5	
A4	4	3	2,5	3	3
A5	4	3	3	3	4
A6	4	4	3	3	
A7	3,5	3	3	3	
A8	3	3	4	3	



Agriculture: planned
A1. Accessibility and optimizing plot
A2. Underwater drainage
A3. Stimulating organic farming
A4. Balanced fertilization

Agriculture: new
A5. Reallocation
A6. Structural periodic wetting
A7. Reduction of pesticides
A8. Flexible water table (agriculture)

Nature: planned
N1. Marshland construction, capillarity
N2. Dredging of the waterways
N3. Realization of natural banks
N4. Extra main watercourse
N5. Minimum water inlet

Nature: new
N6. Repayment of farmers
N7. Reduce non-climate stressors
N8. Prevent spread of invasive species
N9. Two types of ditches (Soomers et al., 2013)
N10. Reducing access
N11. Flexible water table (nature)

(Wardekker et al., 2016;
Thissen et al., in press)

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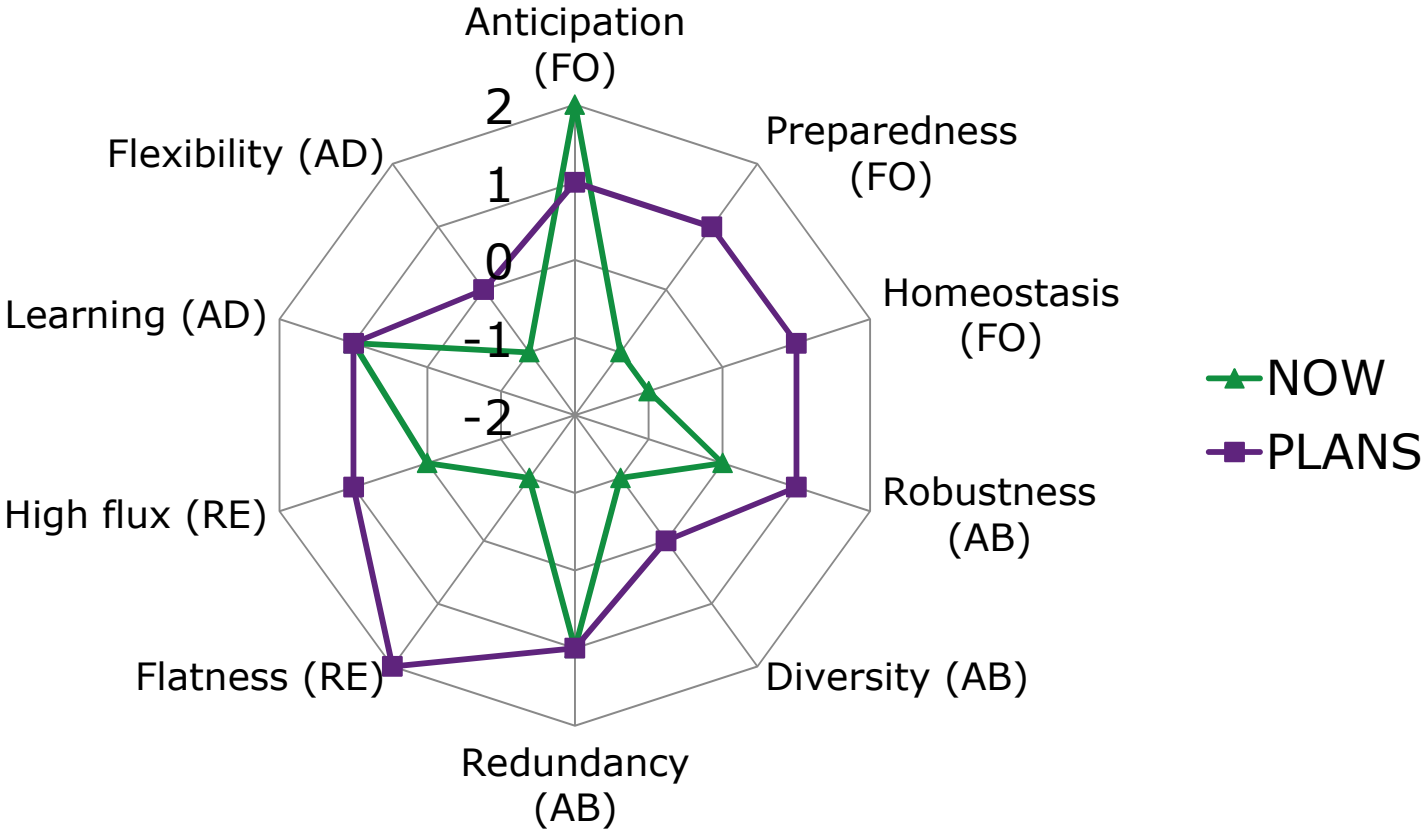
Evaluating options
(example: urban water resilience in Rotterdam)



(Wilk, forthcoming; Wardekker et al., forthcoming)

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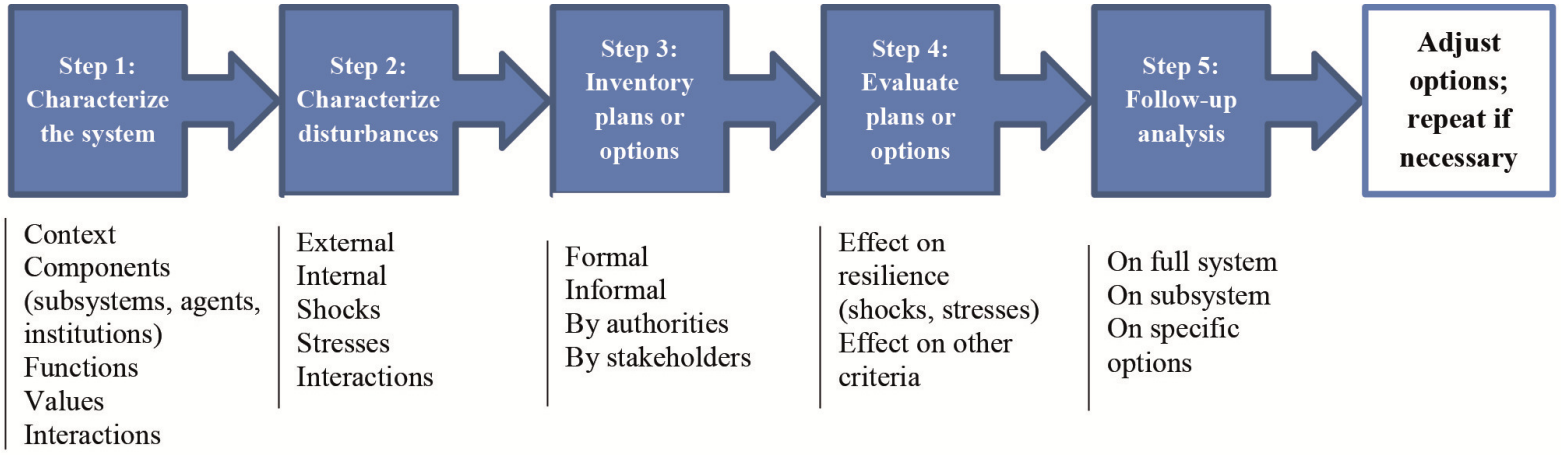
Diagnostic Tool development

- Not just a scoring scale or app!

- User(s)?
- Subject of analysis?
- Context?
- Data sources?
- Evaluation/scoring mechanisms?
- Reflection mechanisms?

Diagnostic Tool development

- Example 1 (Dutch polder peat-meadows)



(Wardekker et al., 2016)

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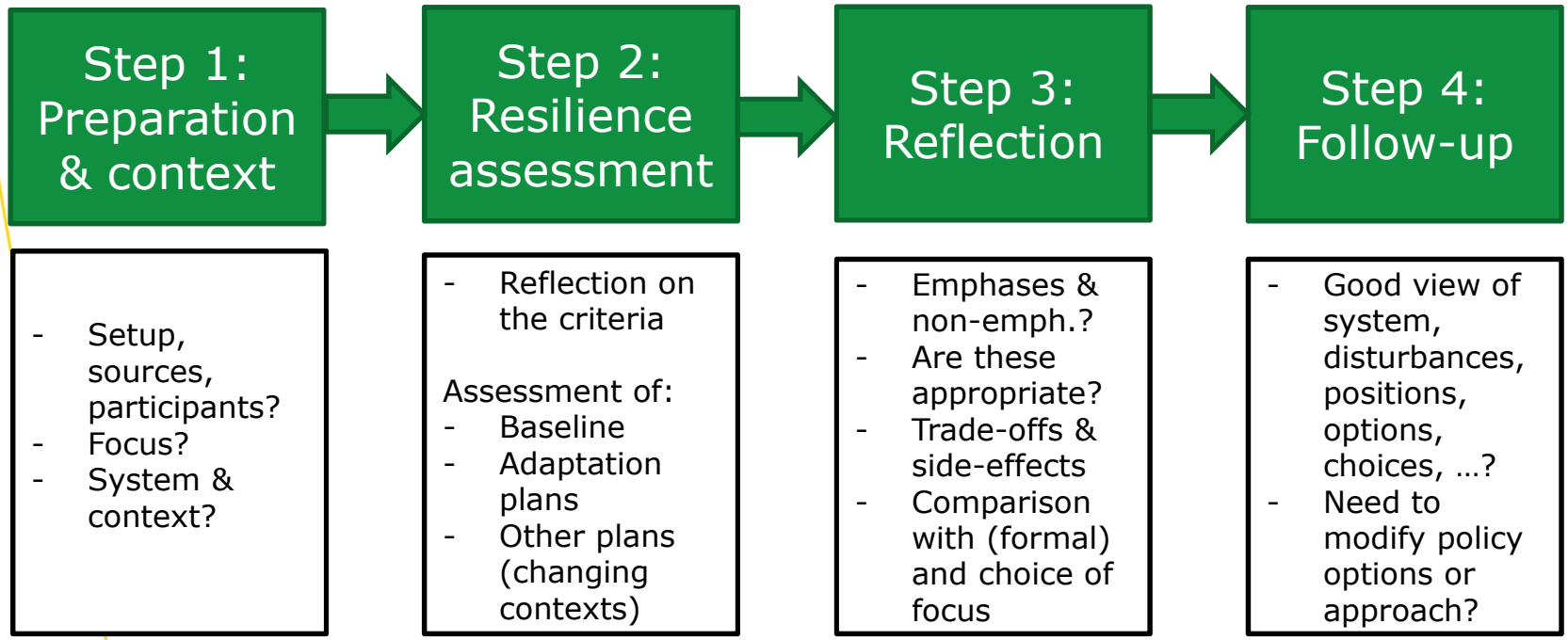
Diagnostic Tool development

- Example 2 (urban climate resilience)



(Wardekker et al., forthcoming)

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Diagnostic Tool development

Challenges

- Trade-offs
  - Between principles
  - Between goals
  - Between stakeholders
  - Between specific subareas, sections, components
- Framing of resilience
  - Short vs. long term
  - System vs. community focus
- Packaging adaptation options
  - E.g., how much is enough, complementarity, etc.?

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