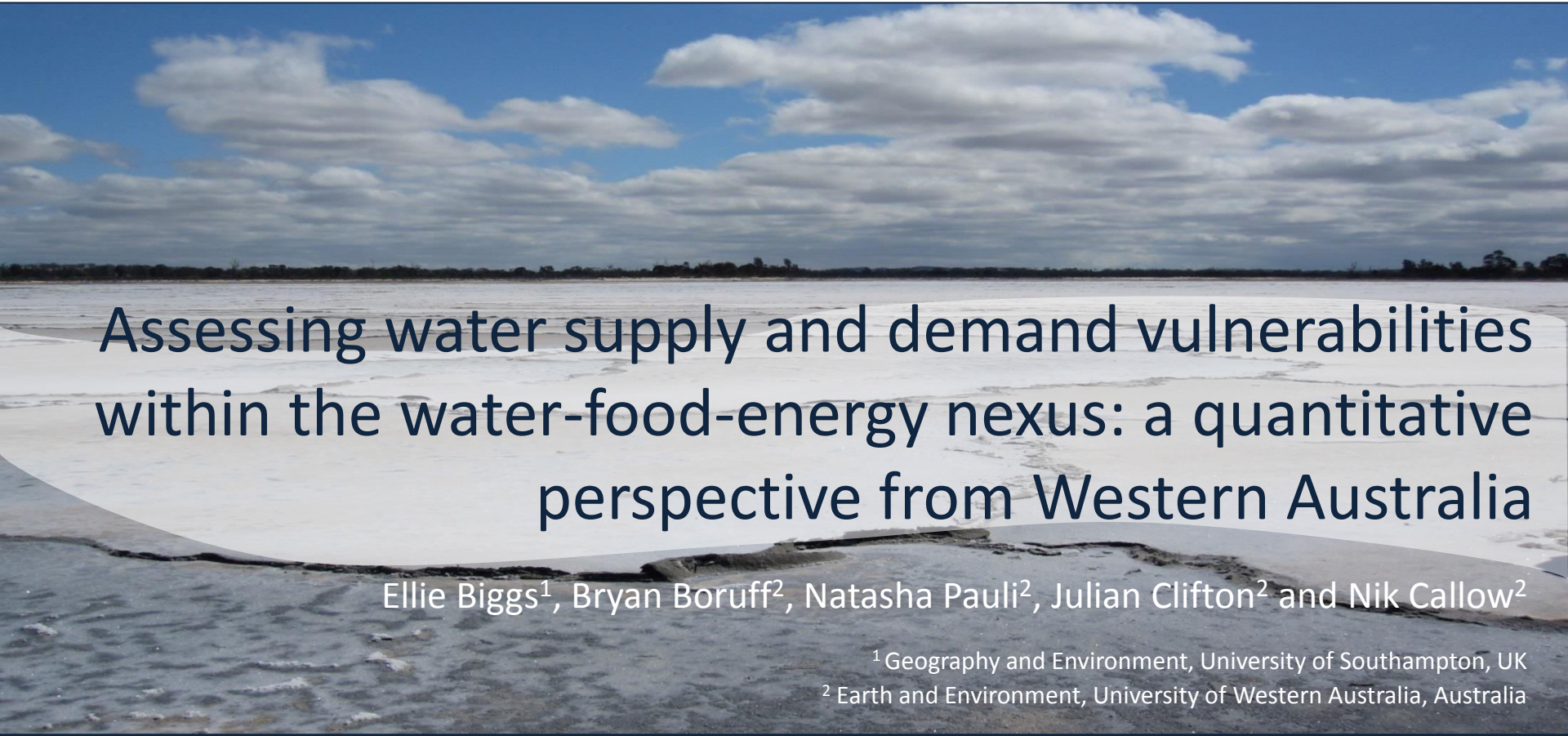

Assessing water supply and demand vulnerabilities within the water-food-energy nexus: a quantitative perspective from Western Australia

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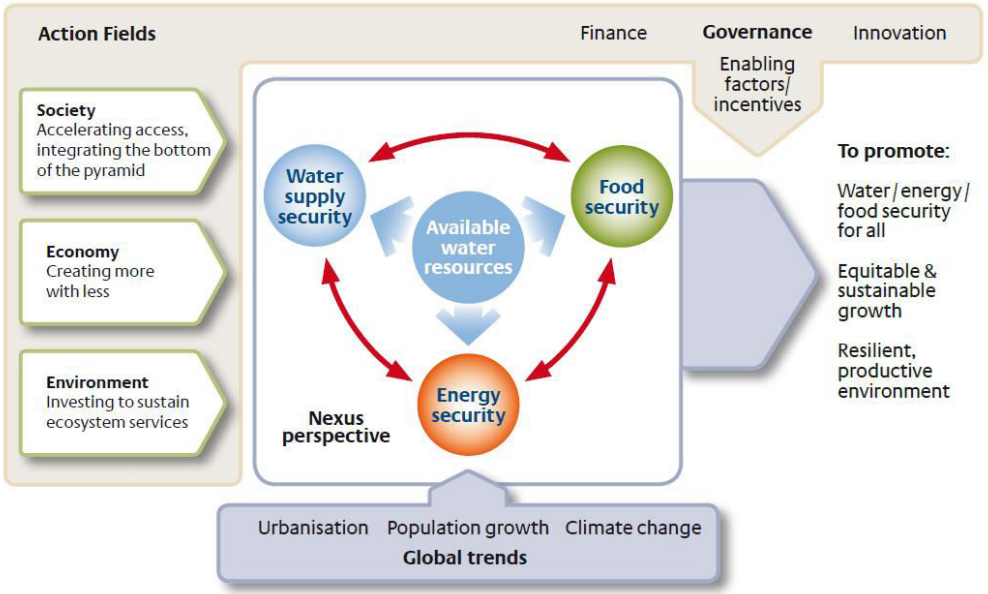
A Nexus Approach



Hoff (2011)

- Accelerating development
- Urbanisation
- Climate change
- Globalisation
- Resources degradation
- Land and water scarcity
- Water-energy-food security

→ How can we measure?

Highly applicable to Western Australia

Spatial Multidimensional Indices

Integrated index

- Representative of environmental and socioeconomic conditions
- Address water-energy-food scarcity
- Promote equal development
- More informative for decision-making
- Greater potential to effectively improve livelihoods

e.g. Sullivan et al. (2008); Cohen and Sullivan (2010); Sullivan (2011); Sullivan and Meigh (2005)

Spatial application

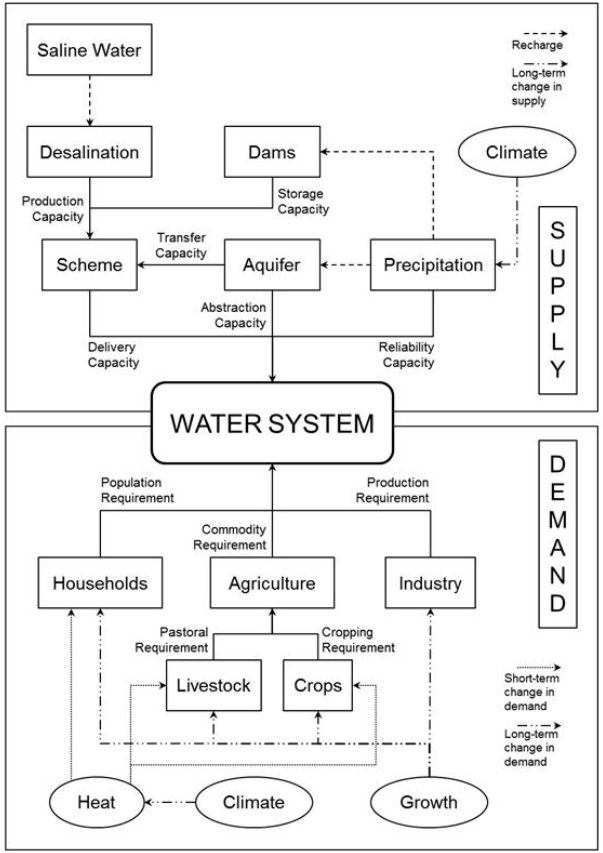
- Appropriate scale for adaptation and coping mechanisms
- Effective targeting for management of resources

The Wheatbelt, Western Australia

- Diverse population
- Rich in environmental resources
  - Minerals & Petroleum
  - Agriculture
- Drive for economic development
- Limited consideration for environmental sustainability
- Push for intensive energy generation and food production
- Freshwater resource scarcity

Wheatbelt Development Commission (2012)

WATER SYSTEM VULNERABILITY



"Water supply is fundamental for supporting and sustaining community and industry development in the Wheatbelt." (WDC, 2013)

→ Assessment of water vulnerability required to build future preparedness

Boruff et al. (in prep)

Calculating Vulnerability

Water System Vulnerability (WSV) = WSSV + WSDV

Supply Vulnerability (WSSV)

- Precipitation characteristics
- Sustainability of aquifer(s)
- Density and capacity of scheme

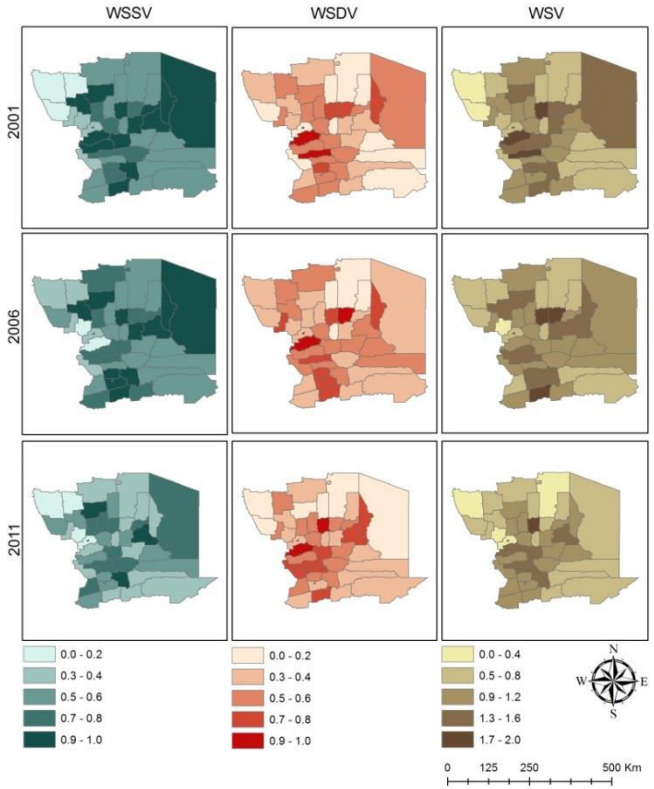
Demand Vulnerability (WSDV)

- Evapotranspiration
- Temperature
- Livestock density
- Land under cropping
- Population density
- Employment in water-dependent sectors
- Distance to scheme

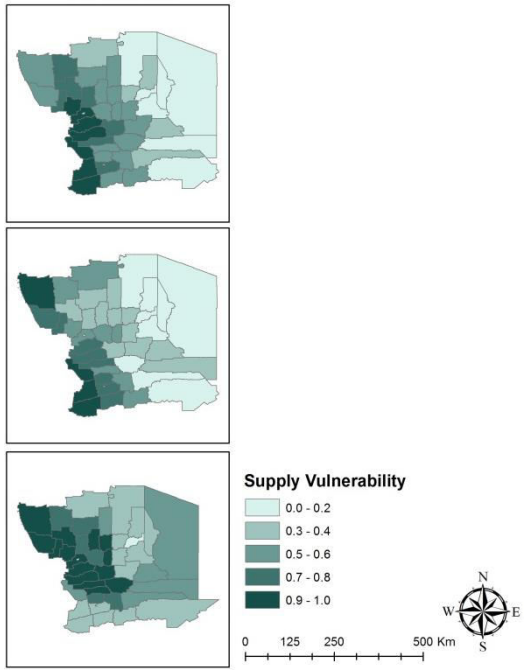
Stepwise regression used to identify dominant variables on system vulnerability

WATER SYSTEM VULNERABILITY

Preliminary results



e.g. Reliability Capacity



Boruff et al. (in prep)

Dominant Vulnerability Indicators

Preliminary results

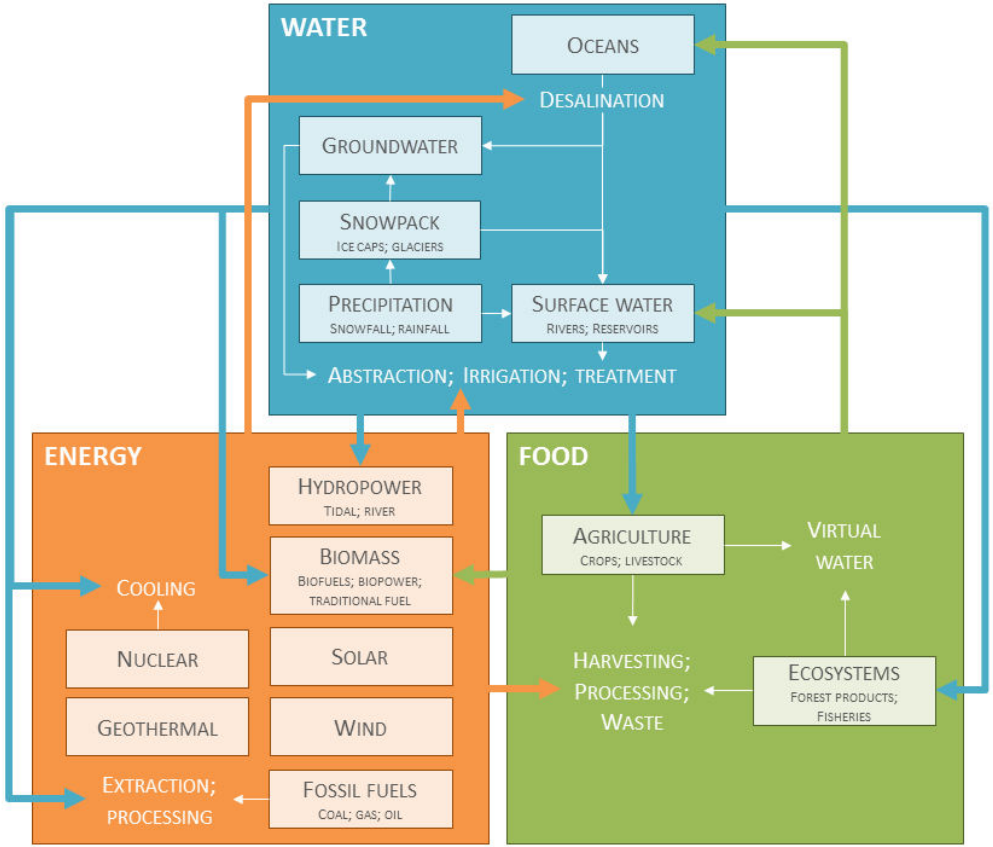
2001	2006	2011
Capacity reliability	Capacity reliability	Capacity reliability
Local water abstraction	Local water abstraction	Local water abstraction
Supply and delivery capacity	Supply and delivery capacity	Population demand
Livestock demand	Livestock demand	Supply and delivery capacity
Crop demand	Industrial demand	Crop demand
Population demand	Population demand	Livestock demand
Industrial demand	Crop demand	Industrial demand

Boruff et al. (in prep)

WSV Index Implications

- Informative planning for Wheatbelt Development Commission
  - Wheatbelt water strategy (action required)
  - Targeting development of technology to reduce demand vulnerability (e.g. scheme expansion) and supply vulnerability (e.g. desalination capacity)
- Can incorporate future pressures and growth rates to reflect projected water vulnerability for region
- Transferable index-building process to apply quantitative system vulnerability concept to other regions
- Potential expansion to consider energy and food systems
  - Better manage trade-offs and synergies between nexus linkages

Water-Energy-Food System Vulnerability



- Determine vulnerabilities within the energy and food systems in Wheatbelt
- Deliver a nexus-based approach for assessing system vulnerability to promote sustainable resource practice

Biggs et al. (in review)

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