The Science-Policy interface: the challenge of *necessary* but *sufficient* complexity

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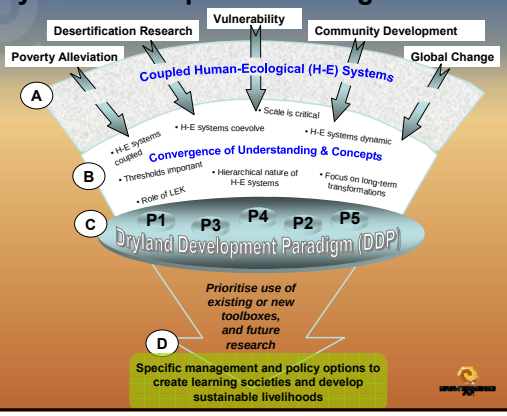
Where I'm going

- **Key issues today are 'wicked', complex**
  - Multi-dimensional, multi-scaled, multi-disciplinary
- **Decision-makers (generally) are not**
  - But must (and will) make decisions
- **Approaches**
  - Disaggregate complexity
  - Summarise complexity
  - Clarify and analyse critical characteristics
- **Today:**
  - Dryland Development Paradigm
    - Australian degradation episodes
  - 'Desert syndrome'
  - Nested typologies…

- **NB ARIDnet is a GLP (and LUCC) network**
- **Led by Jim Reynolds, Duke U**

"Dryland Development Paradigm"



DDP: Five Principles for drylands

P1: Human-Environment (H-E) systems are coupled, dynamic and co-adapting, so that their structure, function and relationships change over time

P2: A limited suite of 'slow' variables are critical determinants of H-E system dynamics

P3: Thresholds in key slow variables define different states of H-E systems, often with different controlling processes; thresholds may change over time

P4: Coupled H-E systems are hierarchical, nested and networked across multiple scales (heterarchical)

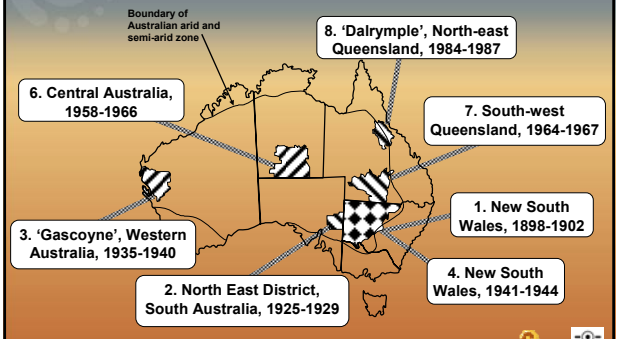
P5: The maintenance of a body of up-to-date Local (Environmental) Knowledge is key to functional co-adaptation of H-E systems

Reynolds et al (2007). Science 316: 847-851

Are the principles + implications useful?

- **Intended as a parsimonious set of tenets**
  - Nothing new in the elements, of course
  - Entrain thinking about ***necessary*** but ***sufficient*** complexity for drylands
  - Help to define, and respond to, the ***right*** problems
    - local management, policy interventions or research
- **Formal 'bottom-up' testing in series of workshops in South America** (see http://www.biology.duke.edu/aridnet/)
  - Mexico, (Argentina), Honduras, Bolivia, Brazil…
- **Parallel thinking behind other developments**
  - PNAS: meta-analysis of '*Learning from History*'
  - Desert Knowledge, etc…

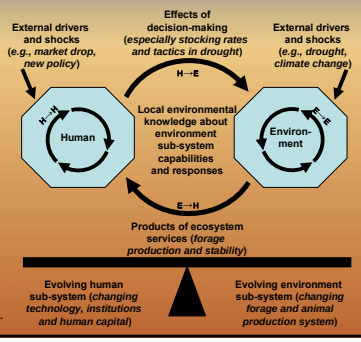
Learning from History case study



McKeon et al (2004): Pasture degradation and recovery in Australia's rangelands: Learning from History

Learning from History case study

- 8 degradation episodes over 100y and 5m km^2



P1 Formulating the analysis

Stafford Smith et al (2007). PNAS 104: 20690-5

Learning from History episode

-10y
- Good prices, good rains, animal numbers increase (P2)
  - Human expectations rise
- Decline in pasture condition (shows in short dry periods) (P3)

0y
- Onset of severe drought +/- market decline
  - Stock retained in hope of rain/price increase
  - Sometimes perverse policy incentives (P4)
- Extended dry period reveals decline in pasture condition (P3)
  - Further damage, big stock losses, human suffering

+5y
- Eventual relief +/- permanent decline in pasture condition (P5)
  - Local learning, reduced stocking rates (P4)
  - 'Royal Commission' reports (too late for intervention)

+20y
- Pastoralists turnover, memory loss over next 20y (P2)

Stafford Smith et al (2007). PNAS 104: 20690-5

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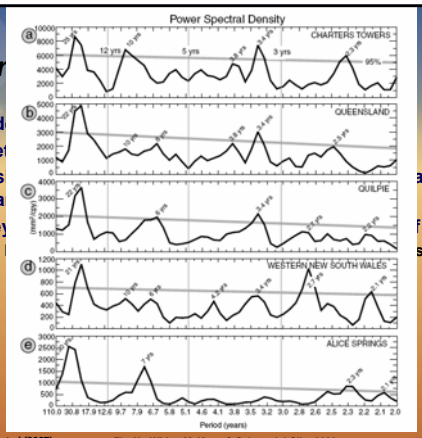
- Key … *'LEK'*
  - … st



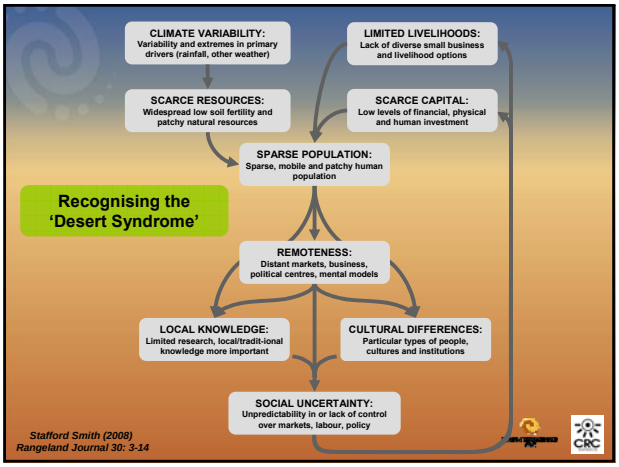
Stafford Smith et al (2007). PNAS 104: 20690-5

Fig.2b, White, McKeon & Syktus, I.J.Clim 2003

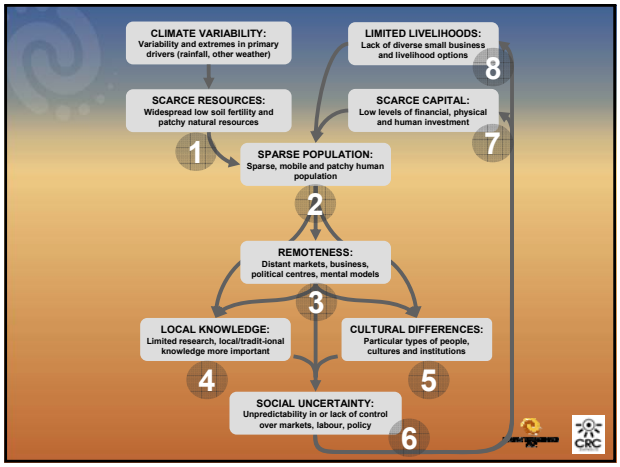
Learning from History case study

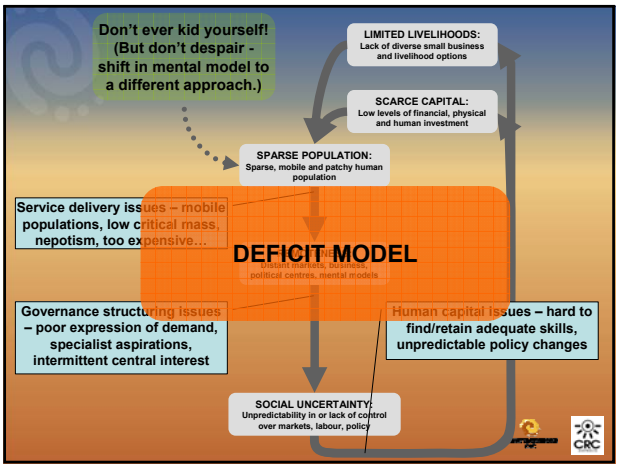
- 8 degradation episodes over 100y and 5m km2
- Meta-analysis taking DDP approach
- Insights from slow variables & thresholds in climate, markets, land condition, on all links
- Key issue in institutional learning and meaning of *'LEK'*
  - Detectable learning on property after episodes, but lost
  - Too local as key variability driver (slow variable) is quasi-decadal, "Inter-decadal Pacific Oscillation" – same time frame as managing lifetime
  - Learning needed at regional scale with regional science
- Highlights value of 'Drought Alert' and 'Safe Carrying Capacity' approaches, linking locals, research and policy into a "regional learning system"

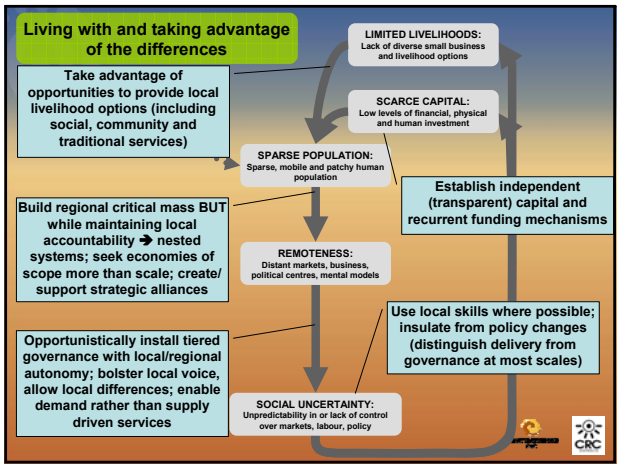
Stafford Smith et al (2007). PNAS 104: 20690-5



Stafford Smith (2008) Rangeland Journal 30: 3-14



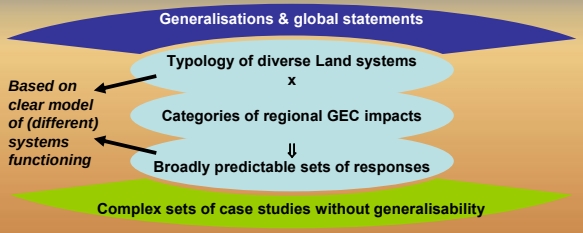


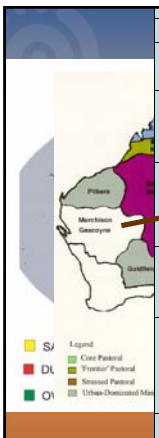


Some governance policy implications

1. **Economies of scope more than scale in extensive regions**
   - Grow non-traditional roles (health, education, etc) not area
2. **Small communities, nepotism and monopolies**
   - Create structures to distinguish roles carefully
3. **Recognise *some* things work differently to populous model**
   - Local Govt may be more about articulating demand and organising services, not *necessarily* providing them all?
4. **Issues for rural and remote areas generally**
   - Beware of isolating Aboriginal 'solution' from its context
   - Capacity takes time to build (be clear on endpoint *and* path)
   - Create local livelihoods / jobs in the process
5. **Balance Rights, Responsibility and Resources**
   - Real subsidiarity (responsibility backed by rights and resources)
   - Multi-tiered ('polycentric') model, balancing accountability with scale

Systematising case studies





Existing regional trajectory		Climate scenario	
Title	*Trajectory description*	*Health implications of a warmer wetter north*	*Health implications of a drier interior with more extremes*
Core pastoral	Dominated by grazing industry and likely to continue to be so	Key health issues related to tropical diseases; current institutions appropriate when functional	Mental health issues will increase in industry
Marginal pastoral	Currently dominated by marginal grazing, but with limited alternative options	Mental health issues largely independent of climate change; significant Aboriginal presence also with poor economic support for health services	Grazing will cease and use will move to Aboriginal (or very marginal, impoverished grazing) in most cases, with poor economic support for health services
Mining	Opportunities in strong mining economy, with other uses marginalised	Strong potential to ally with mining companies for changing model of health services (and extend these to surrounding population); focus on tropical diseases	Strong potential to ally with mining companies for changing model of health services (and extend these to surrounding population); focus on effects of extremes, dust and fire particulates
Tourism	Tourism/amenity uses dominating, dependent on natural and cultural heritage, access to urban centres	Health services will be fully public (existing models) and need to handle visitor population and risks of epidemic transmission	Health services will be fully public (existing models) and need to handle visitor population and chronic responses to heat stress, dust, etc
Aboriginal	Remote Aboriginal homelands with limited services and conventional livelihood options of which arts and crafts are an important component	Major public investment required to build standards; will need to focus on increased tropical diseases and risks of new invasives; opportunities for Aboriginal livelihoods in managing these	Major public investment required to build standards; will need to focus on increased chronic disease risk, and environmental amelioration of dust, fire; opportunities for Aboriginal livelihoods in managing these
'Frontier'	Regions in flux	Model region-dependent (but focused on tropical health issues)	Model region-dependent (but focused on desert chronic diseases)

Campbell et al, Rural & Remote Health (submitted)

Conclusion

- **'Grand' (at least fundamental!) challenge:**
  - Communicating with decision-makers about our science
- **Context:**
  - Greater complexity of issues
  - Need to link global ⇔ regional ⇔ local
- **Some elements of an approach**
  - Delivering *necessary* but *sufficient* complexity
  - Nested typologies based on firm conceptual models of the functioning of systems at different scales
  - Allowing legitimate generalising of *local* case studies + down-scaling of *global* trends to regional/local action arenas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