The Dynamics of Vulnerability: Why adapting to climate variability won't always prepare us for climate change

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A common assertion…

Action taken to reduce vulnerability to current climate variability will help in adapting to climate change.

e.g. Ribot 1996; Schipper and Pelling 2006; Thomalla et al. 2006

…but is this true in all cases?

IPCC SREX (2012):

- "Attention to **the *temporal and spatial dynamics*** of exposure and vulnerability is particularly important given that…disaster risk management strategies and policies can reduce risk in the short term, but may increase exposure and vulnerability over the longer term."
- "It is, however, difficult to make conclusive assessments about the effectiveness of disaster risk management in a changing climate, as overall the evidence base…remains limited and fragmented."

- Put another way, are there really "no regrets" actions?

Vulnerability is a function of :

Exposure + **Sensitivity**

- **Adaptive capacity**

Following Adger 2006 and others

A tale of two countries…

2011 7.2 earthquake in Turkey

2010 7.2 earthquake in Mexico

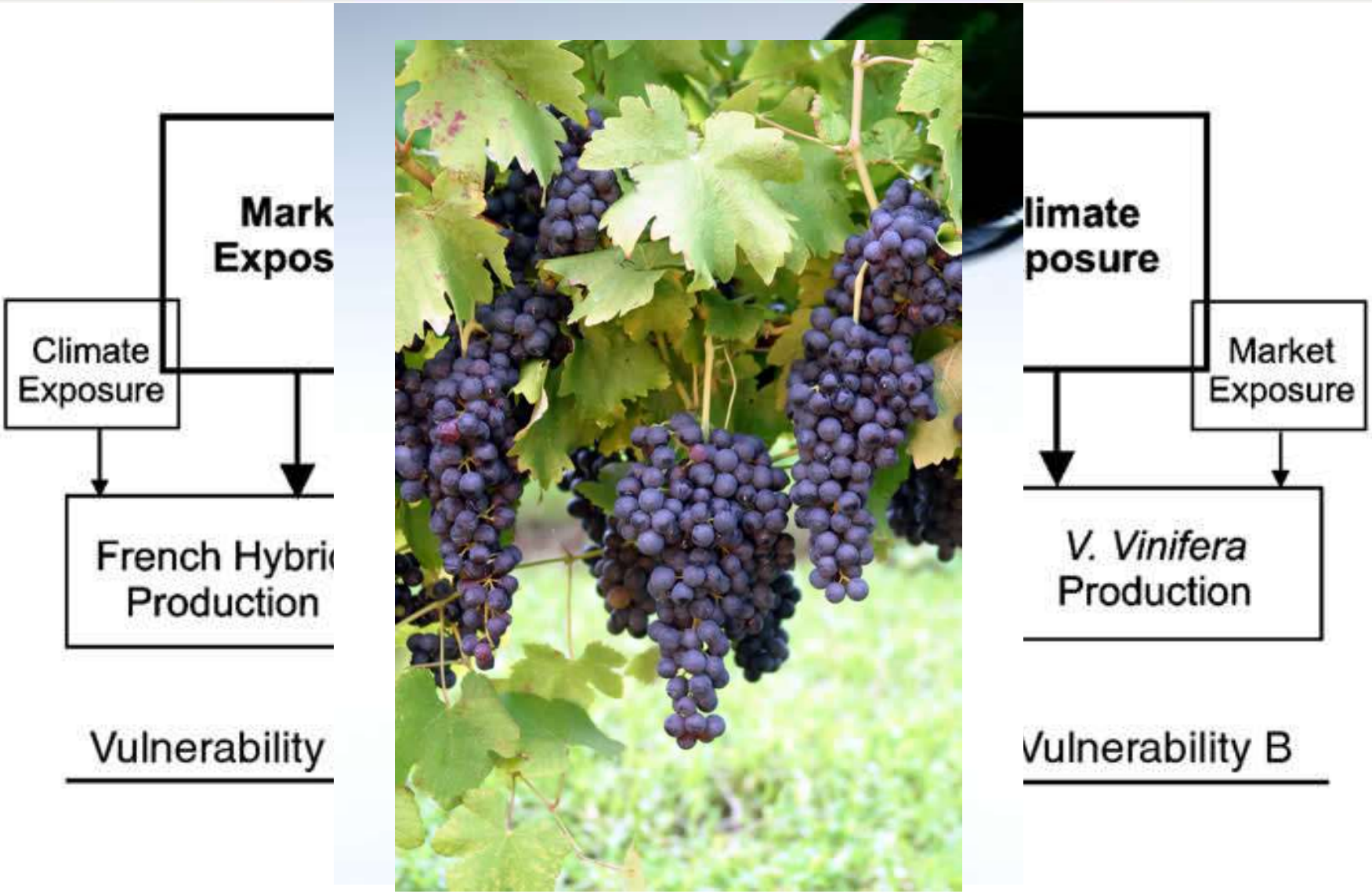
Why focus now on dynamics?

1) there is a growing emphasis in the last decade on merging development, disaster risk reduction, and climate change adaptation practice and the "no-regrets" strategy has been advanced as a practical way of integrating these fields,

2) "no-regrets" rhetoric has been widely applied, despite the fact that there has been little empirical testing of the claims

3) dynamics of vulnerability have been largely excluded from "no-regrets" argumentation

An example of vulnerability dynamics.



LITERATURE REVIEW RESULTS

- **It's difficult to anticipate that adapting to current climate variability will reduce vulnerability to future climate change.**

- Socioeconomic context is constantly changing
  - Population and demographic trends (more people, wealth)
    - Direct and indirect impacts (e.g., development patterns)
  - Advances in technology
  - Shifts in institutions
    - Influences attitudes and behaviors

Why Adaptations to Climate Variability Can Increase Vulnerability

- Adaptations to Climate Variability Change Exposure and Sensitivity
  - E.g.
  - Levee effect
  - Wildfire suppression

Photo: sciencephoto.com

- **Climate change is projected to produce different *exposures* than existing climate variability.**
  - Changes in extremes
  - Non-stationary climate
  - Tipping points

- **Adjustments to other stressors can lead to increased *sensitivity* to existing climate variability**

  E.g. shifting livelihood strategies

  – Ghana shifting to charcoal

  – Shifting to cash crops in Bolivia,

    - Heightened sensitivity to extremes

- **Adaptations Change *Adaptive Capacity***
  - **Path dependency**
  - **Reduced flexibility in some cases**
  - **Risk perceptions**
  - **Masking signals for potentially more destructive events**

- **The Problem of Identifying No Regrets**
  - **"no regrets" for whom?**
  - **Unintended consequences**
  - **Inability to predict all of the future consequences**

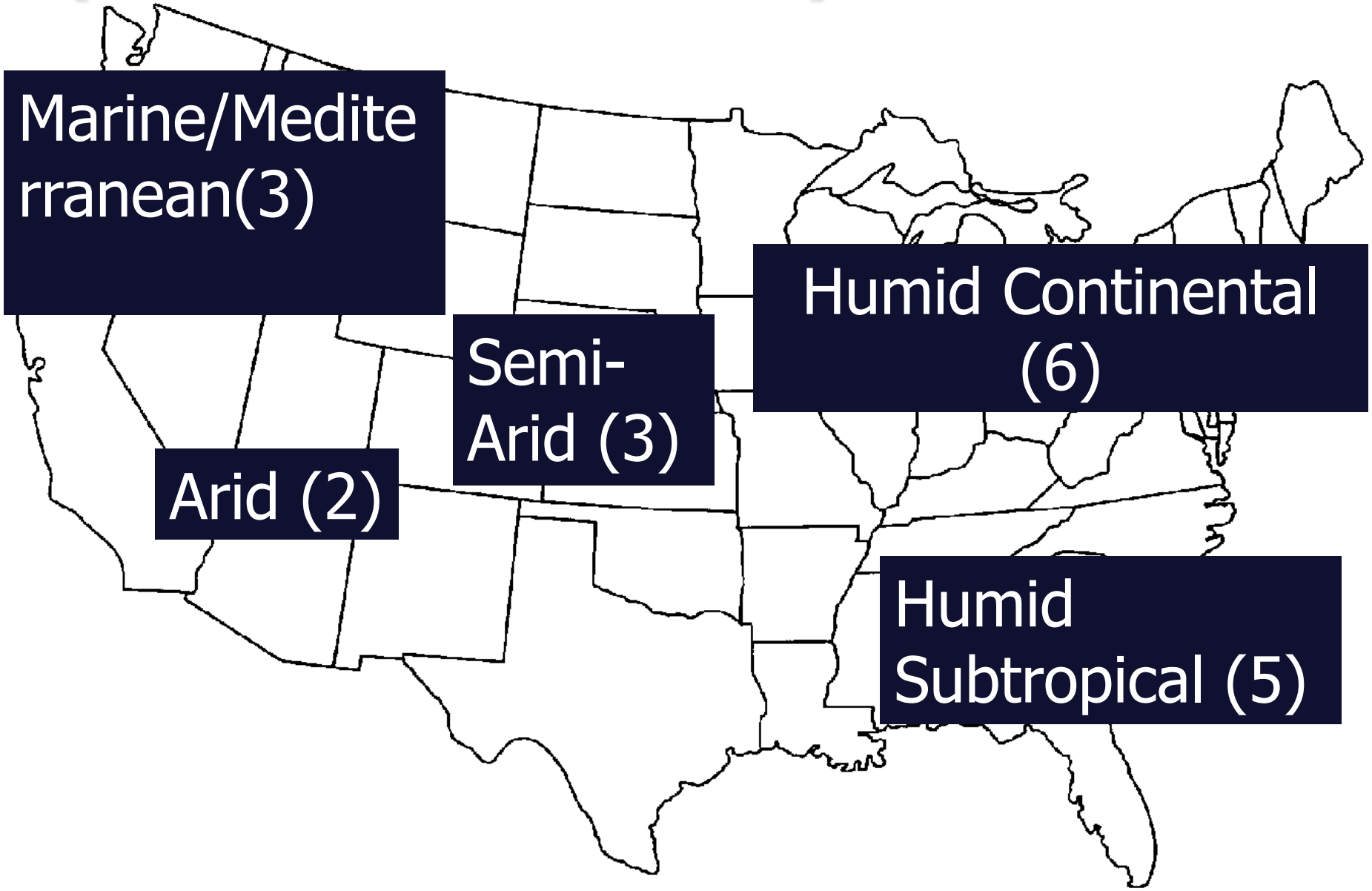
  - **Doesn't mean we shouldn't act, but we need to be more careful to label or suggest any action is really no regrets..**

Dilling et al. 2015 WIRES Climate Change

Main Research Question:

How do policies put in place to reduce short-term drought vulnerability in urban water systems affect capacities to respond to long-term climate change?

Municipal water systems climate zone (# of cities interviewed)



Drought Responses

Top Responses	# of Cities (out of 19)
Conservation - Not during drought	15
Mandatory Reductions	13
Messaging/Public Relations	10
Augment Supply	9
Enforcement	8
Incentives for Conservation	7
Planning	7
Legal	7
Changed system triggers	6
Rate structure	6
Voluntary reductions	6

Perceived Effectiveness

Top Effectiveness measure	# of Cities (out of 19)
Reduction in water use	15
Enabling*	12
System-wide reduction	11
Better Positioned	9
Per capita reduction	7
Long-term conservation	6
Discontinuation of policy	5

* Not measure per se but rather mention of supporting effectiveness

Perceived Limitations

Top Limitations	# of Cities (out of 19)
Social	14
Economic	13
Political	11
Limits Flexibility	10
Physical or Technical	10
Industry or Business	9
Equity	8
Perception	8
Legal	7
Behavior	7

So, back to our question

Initial Problem Definition:

Urban water system vulnerability to Drought

Response → Reduce demand

And/or

Response → Increase supply

Success!

Adaptive Capacity

But…cascades to other domains:

Revenue imbalances

Water quality

Political flexibility

Perceptions and Equity

Implications:

- Wide variety of responses, vary across country but some general patterns
- Vulnerability is dynamic– water supply is part of a linked system (revenue, quality, energy, fire safety, quality of life)
- Decisions made for one reason have other consequences
- Some negatives reported but overall satisfaction with conservation "to do the right thing"
- How important will demand hardening be as climate continues to change?
- Move away from "no regrets" to tradeoffs, balance of goals, at least for well-resourced system e.g. industrialized countries

Next steps and thanks

- Next steps: 3 case studies of larger metropolitan water systems to examine how responses to drought correspond to perceptions about future preparedness

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- Questions?
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