

# Adaptive Regional Resilience Through Negotiated Risk-Sharing Agreements

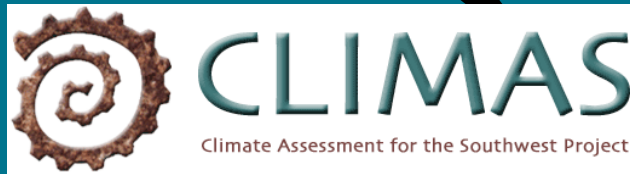
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**Climate Prediction Applications Science Workshop**

**March, 2010**



# Water supply variance and regional economies

- Water use sectors highly interdependent
- Water energy costs linked, big econ impacts
- Large % farm income is off-farm sources
- Bond ratings, ability to borrow
- Tourism, leisure spending by locals
- Property value impacts, insurance costs

# **“Optimizing” Water Supply Reliability Around Regional Economic Vitality**

water supply portfolios for differing risk-  
reliability needs & ability to pay


adaptation to minimize econ dislocation

short vs long term adaptation

# Sharing Water Supply Reliability Risks

- Voluntary regional agreements across water using sectors and locations
- Activated by specified trigger conditions
- Motivated by differences in costs of shortage across sectors and locations and willingness-to-pay

# Risk-sharing: high value perennial crops and low value fields crops

- Orchards and wheat, for instance
  - Preserving high profit crops NOT same as preserving ag jobs
- 

# Risk-sharing: urban water provider and irrigation district

- Urban provider – avert costs of severe water rationing
- Habitat managing agency – avert species die off due to low flows, temp, quality
- Irrigation district – implement voluntary program to cease irrigating marginal fields

# Triggers to Activate Water Sharing Agreements

- reservoir levels, snowpack conditions
- seasonal climate & water supply forecasts
- new CLIMAS RISA project – economic stakes linked to forecast skill
- “it’s a forecast, not a contract...”

# Perils of Risk-Sharing Contingency Agreements

## Type I Error - FALSE ALARM

- water sharing agreement implemented
- irrigated acreage cut back
- water not needed ... late spring storms or cooler summer weather.



## Type II Error

Risk-sharing agreement NOT implemented

Shortage occurs in most vulnerable areas

High costs and economic dislocation

A decorative graphic consisting of several thick, black, wavy lines that flow from the bottom right towards the center of the slide, set against a teal background.

Type I Errors - in unnecessary cessation of irrigation and water acquisition costs

Type II Errors - water shortage costs which could have been averted

Which is water manager's "worst nightmare"?



As if Type I and II Errors weren't  
enough to worry about...



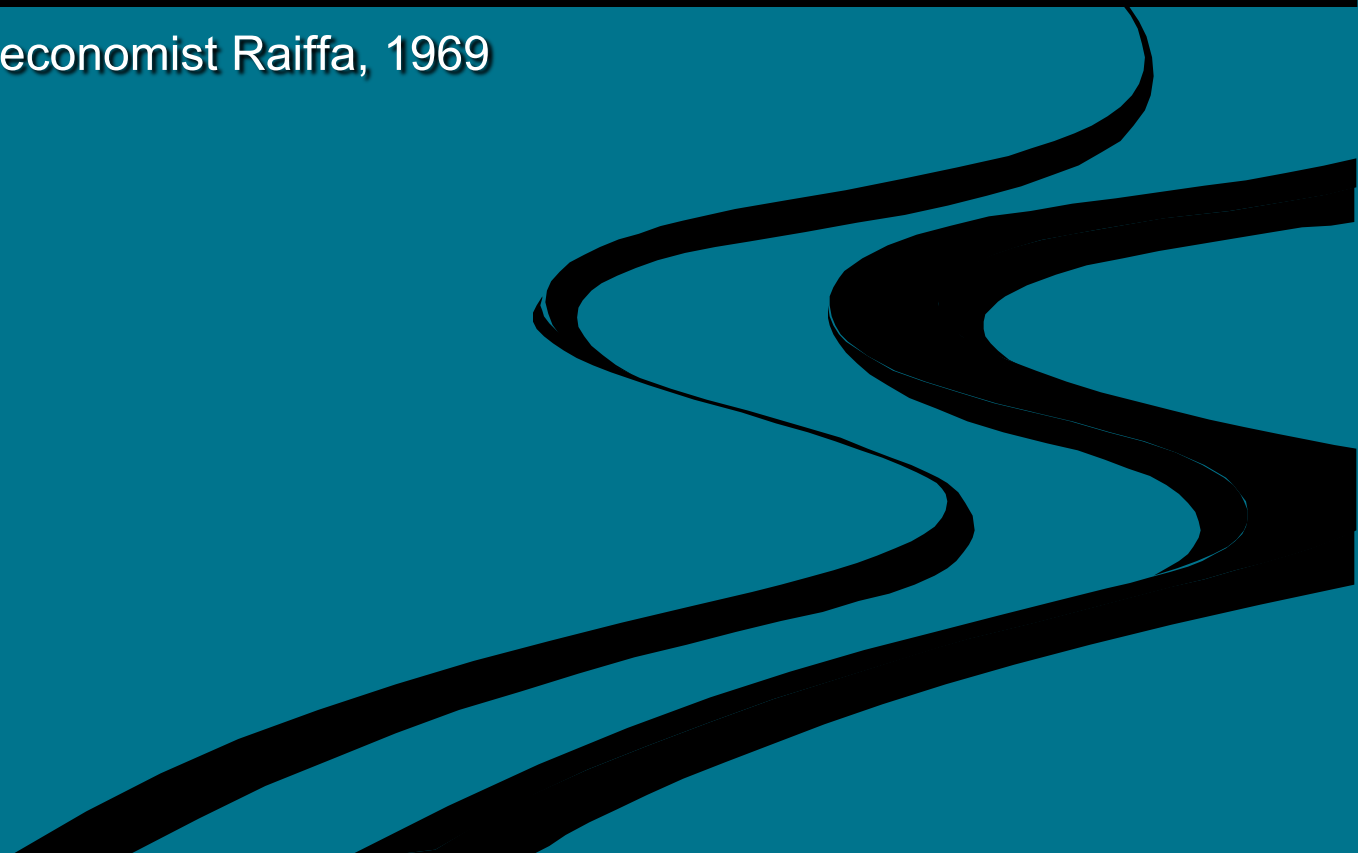
As if Type I and II Errors weren't  
enough to worry about...

Type III Error “*solving the wrong problem...  
when one should have solved the right  
problem*” Mitroff and Featheringham 1974



As if Type I and II Errors weren't  
enough to worry about...

Type IV Error “*solving the right problem too  
late*” Harvard economist Raiffa, 1969



# Adaptation Agreements - What Do We Need to Get Better At?

- Ag crop cycles, seasonality
- Urban areas: what's it really worth to avoid water restrictions, electricity brownouts?
- Addressing peak resource usage - seasonal and time-of-day water and energy use

# “smart following”

- seasonal irrigation forbearance, rather than year-round (apologies to cold regions)
- significantly decreases costs of forbearance
- requires cost-effective monitoring to ensure fields not irrigated for dates agreed
- remote sensing monitoring protocols, “ground truthed”

# three new stakeholder guidebooks

- [ag.arizona.edu/arec/people/profiles/colby.html](http://ag.arizona.edu/arec/people/profiles/colby.html)
- O'Donnell and Colby, University of Arizona, Agricultural and Resource Economics
- *Water Banks: A Tool for Enhancing Water Supply Reliability*, January 2010
- *Dry-Year Water Supply Reliability Contracts: A Tool for Water Managers*, October 2009
- *Water Auction Design for Supply Reliability: Design, Implementation, Evaluation*, May 2009.



# Resilience – for the long haul



Roman Aqueduct,  
Pont du Gard,  
France

***Thank you!***

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