

Till the wells run dry? Dealing with groundwater depletion in California and Victoria, Aust.



Source: 29 Palms Water District

Toward Sustainable Groundwater in Agriculture
June 15, 2010

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Overarching research question



How do state-level written laws provide for controls on groundwater depletion, and **how are these controls implemented through local rules and plans?**

- California, USA
- Victoria, Australia

Research sub-questions

- How is groundwater depletion *measured*?
- To respond to what *problems*?
- How *serious* are the problems?
- What *tools* are used? (regulatory, economic, voluntary / physical approaches)
- Is the approach:
 - Different between California and Victoria?
 - Related to the *nature* of the problem?
 - Related to the *gravity* of the problem?



Descriptive, univariate

Descriptive, bivariate

Overview- legal frameworks

- California
 - Bespoke: special districts
 - Generic: water agencies adopt GW mgmt. plans
→ *Autonomous local action; local "self-regulation"*
- Victoria
 - State declares problem areas
 - Local committees formulate GW mgmt. plans; State approves; regional agencies implement
→ *State regulation through local bodies*



Methodology

- Content analysis
 - Decision-making & stakeholders
 - Information
 - Management planning
 - Tools to control depletion
- Context:
 - severity & type of GW depletion problems
 - agency role
 - agency revenue

Laws/ rules/ plans	Cal. special districts	Cal. water agencies	Vict. water agencies
State-level	16	9	1
Local-level	12	45 (sample)	7

Cal.	Vict.
<ul style="list-style-type: none"> • DWR Bull. 118 • Controller's Rpt 	<ul style="list-style-type: none"> • Vict. Monthly Water Rept • Agency Ann. Rpts.

Hypotheses

Less robust: voluntary and physical

More robust: economic and mandatory



Stable or not evident No irreversible impacts	1. Status of depletion 2. Impacts of depletion	Serious and worsening Irreversible impacts
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Key findings: State written laws

- Very different governance structures
- Similar:
 - Information gathering (exc. metering)
 - Management planning
 - Legal tools to control depletion

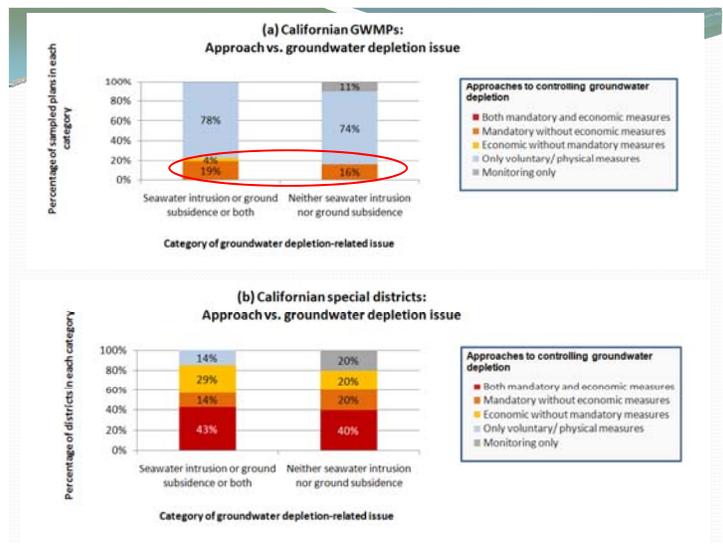
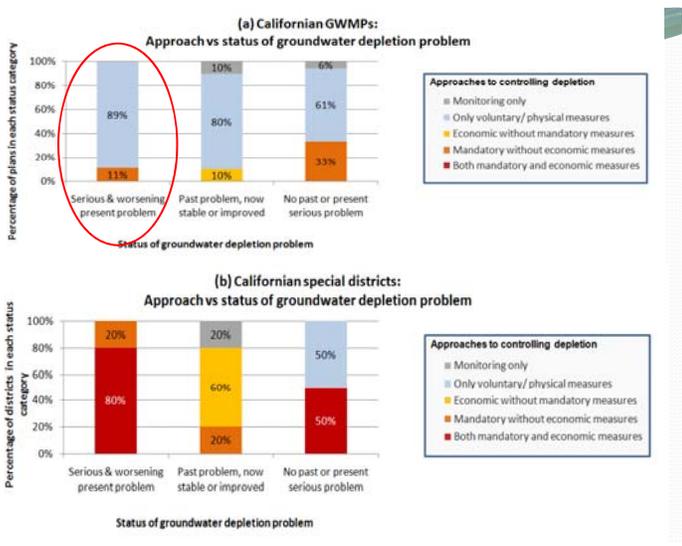
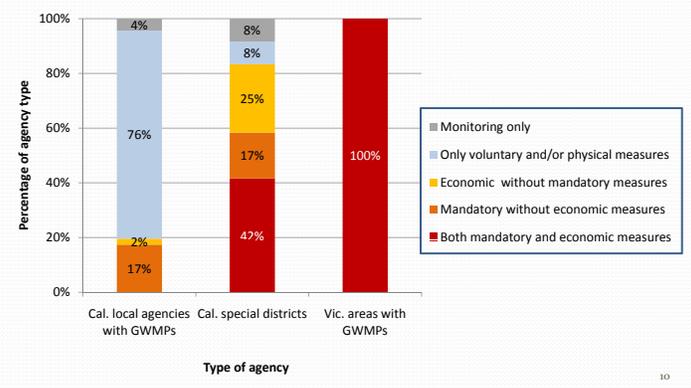
Key findings: Local plans & rules

- Similar
 - Types of depletion problems
 - Spectrum of gravity of depletion problems
 - Range of tools (mandatory, economic, voluntary/physical)

Key findings: Local plans & rules

- BUT tools are used to very different degrees
 - Vict.: agencies all limit extraction & charge fees
 - Cal.: rarely do so, or foresee doing so
 - Especially unlikely when depletion problems are serious & worsening
 - Apparently unrelated to type of depletion problem

Approaches to controlling groundwater depletion used by institutions in Cal. & Vict.



Hypotheses (Cal.)

Less robust:
voluntary and physical

More robust:
economic and mandatory



Stable/not evident	1. Status of depletion	Serious & worsening
No irreversible impacts	2. Impacts of depletion	Irreversible impacts

Findings
→ Opposite rel'p
→ No diff.

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Conclusions & take-home

- Despite having strong legal powers to control depletion, few Cal. GWMP agencies use them...

- ...especially in areas suffering serious & worsening depletion-related problems

- Cal. special districts much more likely to use more robust measures

- Compare Vict.: agencies universally use robust measures

- Note different governance structure

19% of all GWMP agencies, 11% of those with serious depletion problems

84% of all special districts, 100% of those with serious depletion problems

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Future research

- Case studies – focus on social/economic/political motivators for groundwater management in overdrafted areas
 - Why do some Cal. agencies choose to regulate, when they aren't forced to?
 - What effects has regulation had on the ground?

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Acknowledgements

- Professors Barton (Buzz) Thompson, Jr. & Michael Wara, Stanford Law School
- The General Sir John Monash Foundation, Melbourne, Australia

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Questions

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Focus and context

- Focus:
 - GW quantity
 - in-basin
 - self-supplied by users



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California – GWMP framework

- Funding requirement
- Local water agency:
 - May not **limit or suspend** extractions unless “groundwater replenishment programs or alternative sources of water supply have proved insufficient or infeasible...”
 - **May charge for extraction or replenishment** if voter majority approves



Bottom line: significant existing legal power to control groundwater depletion

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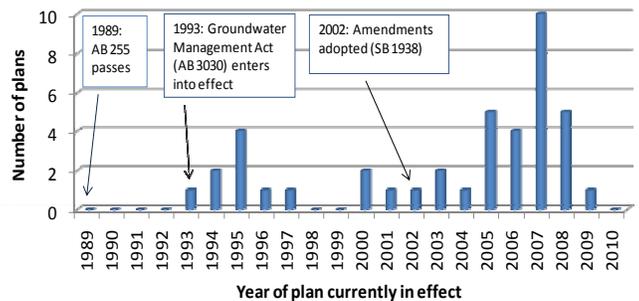
Cautionary note

- Preliminary results: random sample of 50 plans
- Variation
 - Physical situation
 - Governance arrangements
 - Plans: date, implementation orientation
 - Financial resources



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Groundwater Management Plans in California: Year of plan currently in effect



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Method – coding plans & rules

	Category	Sub-categories
DECISION-MAKING	Lead agency type	Irrigation district, water district, reclamation district, etc.
	Advisory committee reps	Agricultural, urban/municipal, environmental, other
PLANNING	Management issues addressed by the plan	Overdraft; groundwater levels/quantity; ecosystem effects; seawater intrusion; other water quality impacts; subsidence
	Monitoring	GW level; GW quality; other; new/enhanced need
INFORMATION	Well information	Well registration, metering, reporting
	Review the plan	
	Report plan implementation	
APPROACHES TO COMBATING GW DEPLETION	Regulatory approaches	General extraction limits; restrictions on new wells; mandatory conservation; waste prohibition
	Economic approaches	Groundwater use-based fees (extraction or replenishment fees): uniform; tiered; unspecified
	Voluntary and physical approaches	Conjunctive use arrangements; replenishment activities; water recycling; voluntary conservation; education; water imports
	Date	
CONTEXT	Whether ag. water supplier	
	Gravity of groundwater problems	Serious and worsening present problem; past problem now improved or stabilized; no past or present problem

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