Simplicity and Reality

The Theory and Practice of Water Markets

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Setting the Scene

- This lecture addresses one question: Why do water markets flourish in some places, but not in others?
- The context for my work is China and to some degree globally.
- My aim is to present some research on water markets globally that I have been working on with colleagues from the University of Oxford and University of Waterloo among others.
- At this point, we have mostly questions, not answers.

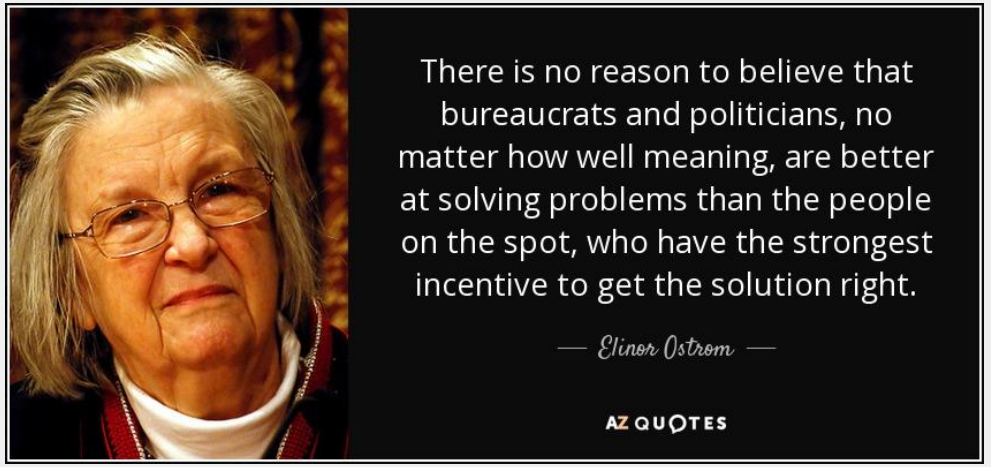
Background: Tragedy of the Commons

- Greed and self-interest is not always good and can lead to a 'tragedy of the commons'.

- Garrett Hardin (1968) offered two solutions to problems of overexploitation of natural resources: 1) state control of resources; or 2) sell them off as private property.

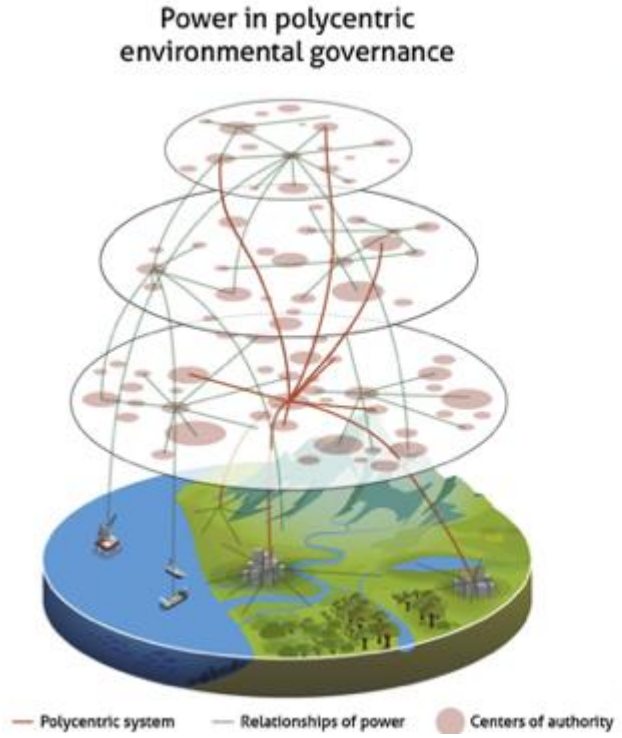
Background: From Tragedy to Hope

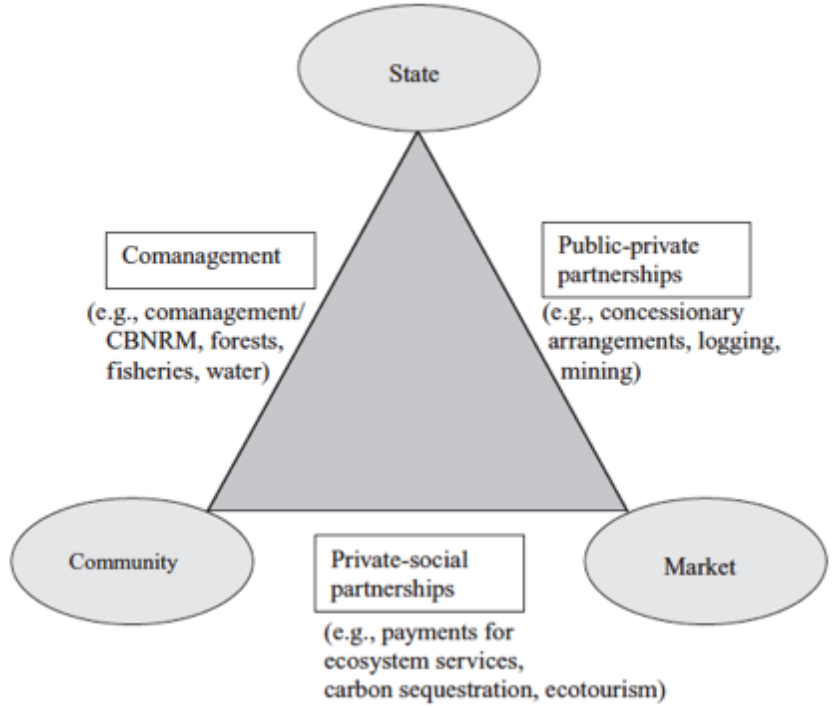
- Over the 1980s and 90s, growing evidence showed that communities of natural resources could also self-organize for the management of resources.
- Elinor Ostrom (1990) demonstrated that natural resources can be effectively managed collectively, without government or private control.
- First woman Nobel Prize winner in Economic Sciences (2009).
- Key implication: Avoid one simple solution (e.g., government ownership, privatization, or community property) to environmental problems.



Beyond a single governance mode (states, markets or communities)

Norms, networks and new types of collaboration and governance in the 21st century





Nyborg et al., 2016.
Social norms as solutions.
Science, 354(6308), pp.42-43.

Morrison et al., 2019.
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Lemos and Agrawal, 2006.
Environmental governance.
Annu. Rev. Environ. Resour., 31, pp. 297-325.

But in the 21st century…..

- There are **two billion** more people since Ostrom's classical study from 1990.
- And **urban populations** have **nearly doubled**, accelerating regional and global challenges that outstrip capacity for one governance mode (states, markets or communities) to solve alone.
- A case in point is the Colorado River Basin in North America

- January 2000: Lake Powell + Lake Mead 90% Full

- April 2022: Lake Powell + Lake Mead less than 30% Full

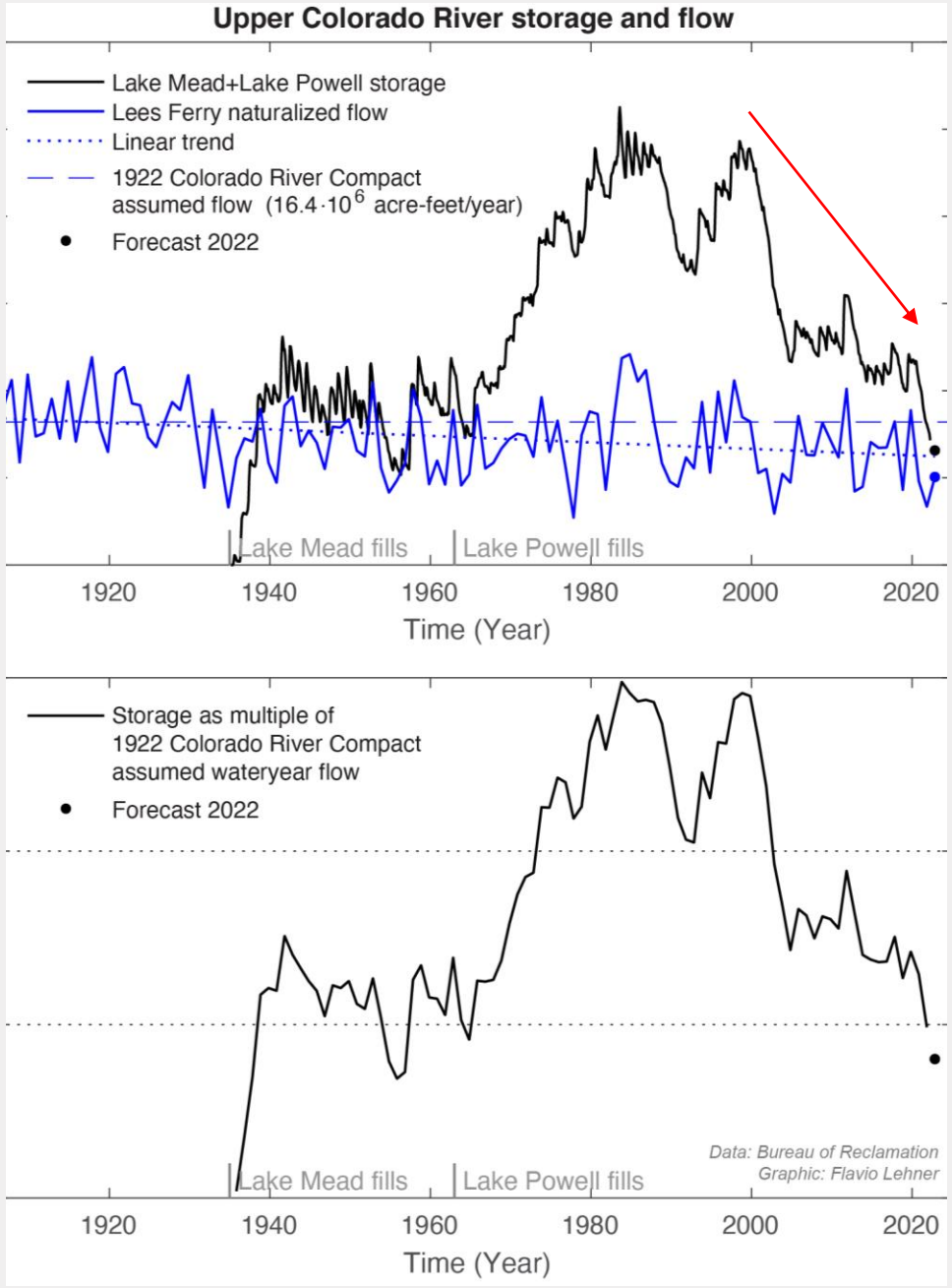
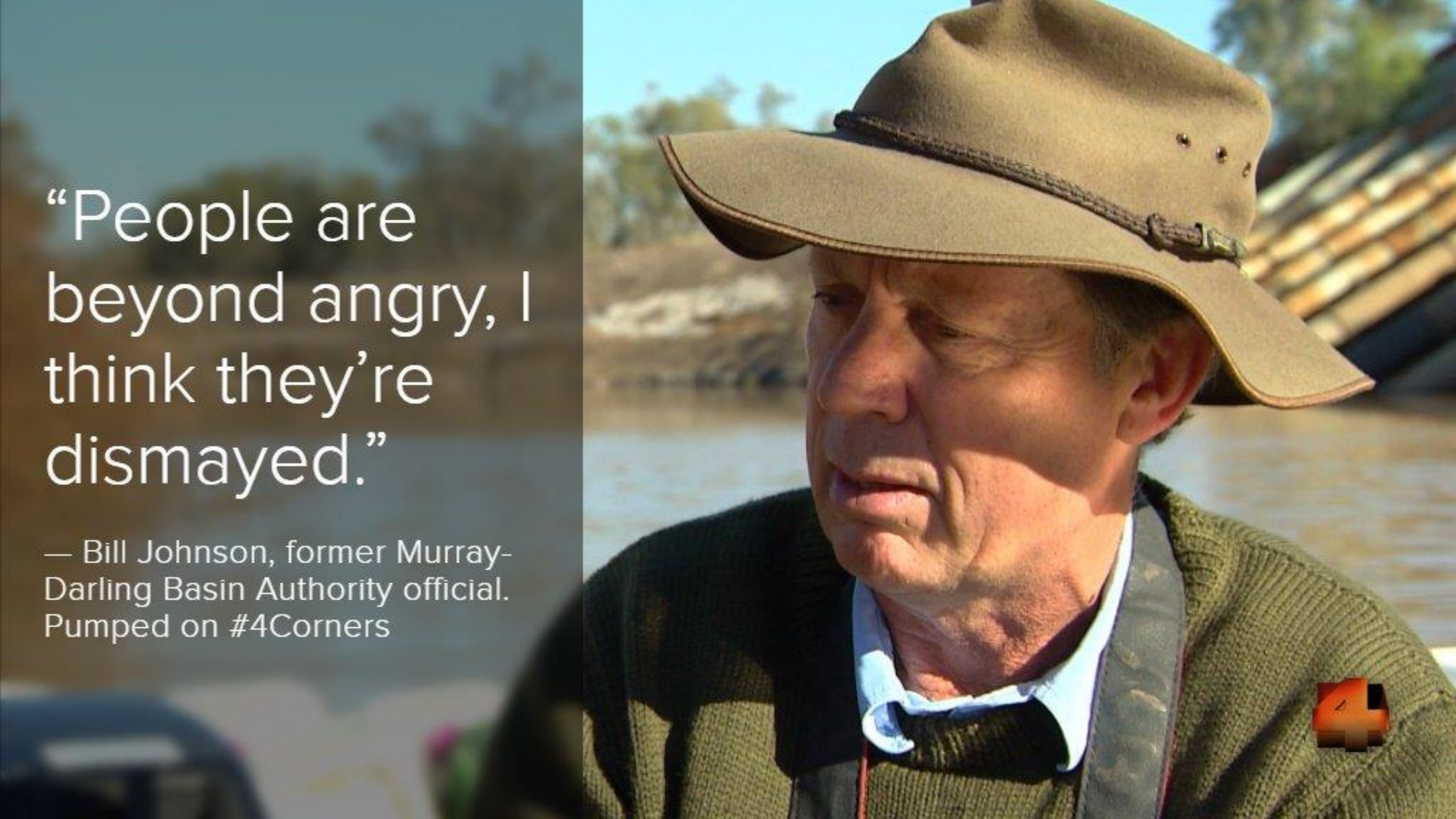


Figure: Flavio Lehner, Cornell University, 2022


Las Vegas
Lake Mead
Hoover Dam
2000
10 km
N


“People are beyond angry, I think they’re dismayed.”
— Bill Johnson, former Murray-Darling Basin Authority official. Pumped on #4Corners

The Merchants of Thirst

In Nepal and many other countries, private tanker operators profit from growing water scarcity.

What are markets?

The market community as such is the most impersonal relationship of practical life into which humans can enter with one another.
– Max Weber (1922)

A market is an institution through which multiple buyers or multiple sellers recurrently exchange rights to a substantial number of similar goods or services of a particular type.
– G Hodgson (2019)

Hodgson, G.M., 2019. Taxonomic definitions in social science, with firms, markets and institutions as case studies. *Journal of institutional economics*, *15*(2), pp.207-233.

Definition of water markets: The Simple Story

- Water markets function efficiently when water rights are well defined and sufficiently flexible.

- The economic literature assumes water markets with:
  - Perfect Design
  - Full participation
  - Maximum gains from trade between the seller and the buyer

- In many cases, this is not the case. Why? Conflict of interests = Failure to clarify and modify water rights.

- There needs to be a political strategy along with an economic one to bring about change.

Water involves private goods, public goods and common pool resources

Economic goods distinguished by their excludability and rivalry (subtractability)

Definition of water markets: Reality on the ground

- There are different ways in which water might be exchanged.
- **Formal market:** an adjudication or permitting process for access to the water source, as well as rules governing reallocation, treatment, delivery and storage. Trade occurs with full transparency regarding price, quantity and the identities of the buyer and seller.
- **Informal water markets** can also be established, which involve transactions that lack legal status or occur in the absence of regulation. They rely on local rules and norms. For example, a farmer happens not to need this week's allocation of water and the farmer allows his neighbor to take it instead without taking money and there is no formal record of the exchange.

The diversity of water markets

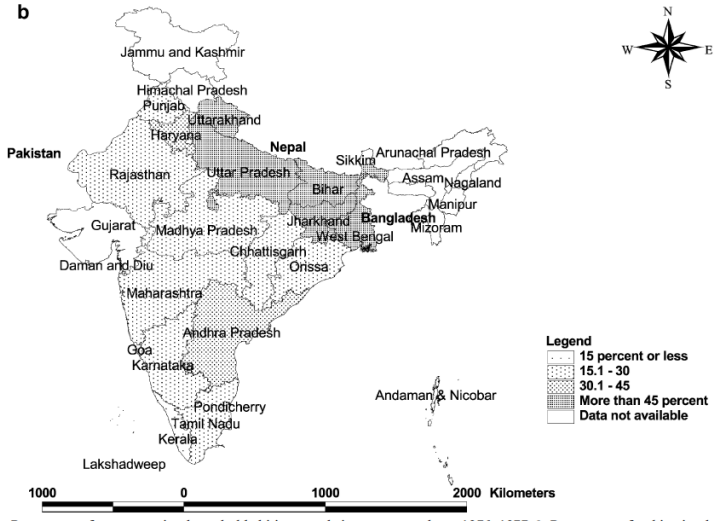
Different goods and services, different institutions, different political economy

Tradable water rights

e.g. formal water markets in Australia, China, Chile, West USA.

Small-scale water providers

Private groundwater irrigation services



e.g. informal water markets in Nepla, India and places in Africa.

Mukherji, A., 2008. Spatio-temporal analysis of markets for groundwater irrigation services in India: 1976–1977 to 1997–1998. *Hydrogeology Journal*, *16*(6), pp.1077-1087

More distinctions of water markets

1. One year lease
2. Multi-year lease
3. Permanent sale

- In practice, the conditions to be satisfied for (2) and (3) are the same.

- The functions they serve are different though.

1. One year lease = provides short-term flexibility but not long-run reallocation.
2. Multi year lease or permanent sale = provides long-run reallocation, but not short-term flexibility.

Conditions under which exchanging water is smooth

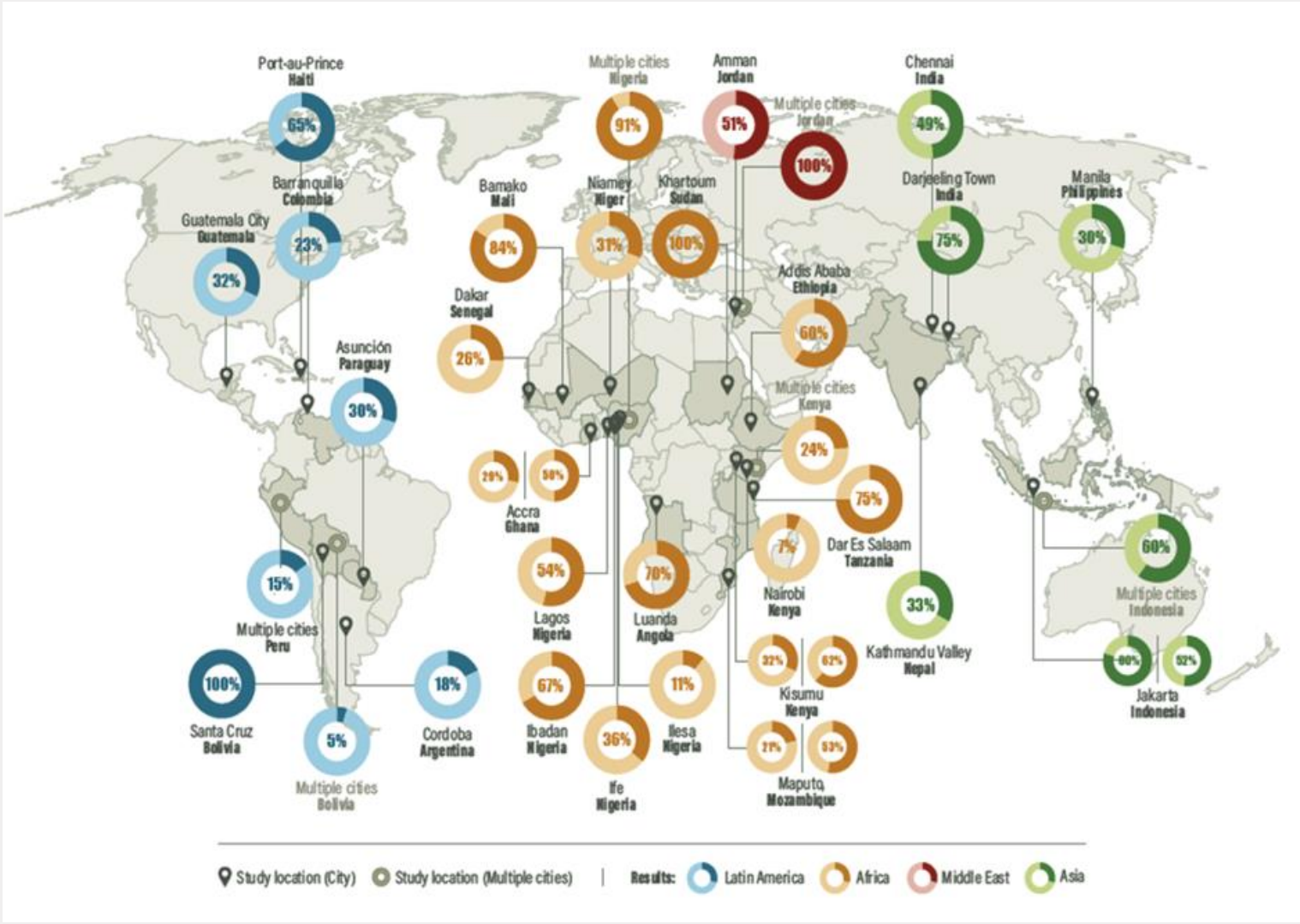
1. Good physical connectivity between seller and buyer. This could be established via physical infrastructure or natural connectivity (using same well or irrigation channel).
2. No issues or barriers regarding water right. Right of seller to sell and buyer to aquire is well accepted and not challenged.
3. No cost issues or barriers with regard to financing of the water being exchanged.

- If these basic conditions are ***met***, water trading happens.

- Examples of where they are met:
- Exchanges among customers of a retail or wholesale distribution system
- Water vendors (e.g. tanker trucks)
- Groundwater sales by irrigation farmers

- In **reality**, informal water markets – such as Water vendors – flourish around the world and temporary (short-run) trading is also common, but ***not*** permanent trading.

Informal water markets: Percentage of sampled population purchasing vended water globally



Garrick, D., O'Donnell, E., Damania, R., Moore, S., Brozović, N., Iseman, T. 2019. Informal water markets in an urbanising world: some unanswered questions. © World Bank

Murray-Darling Basin, Australia

Water recovery for wetland conservation and river function

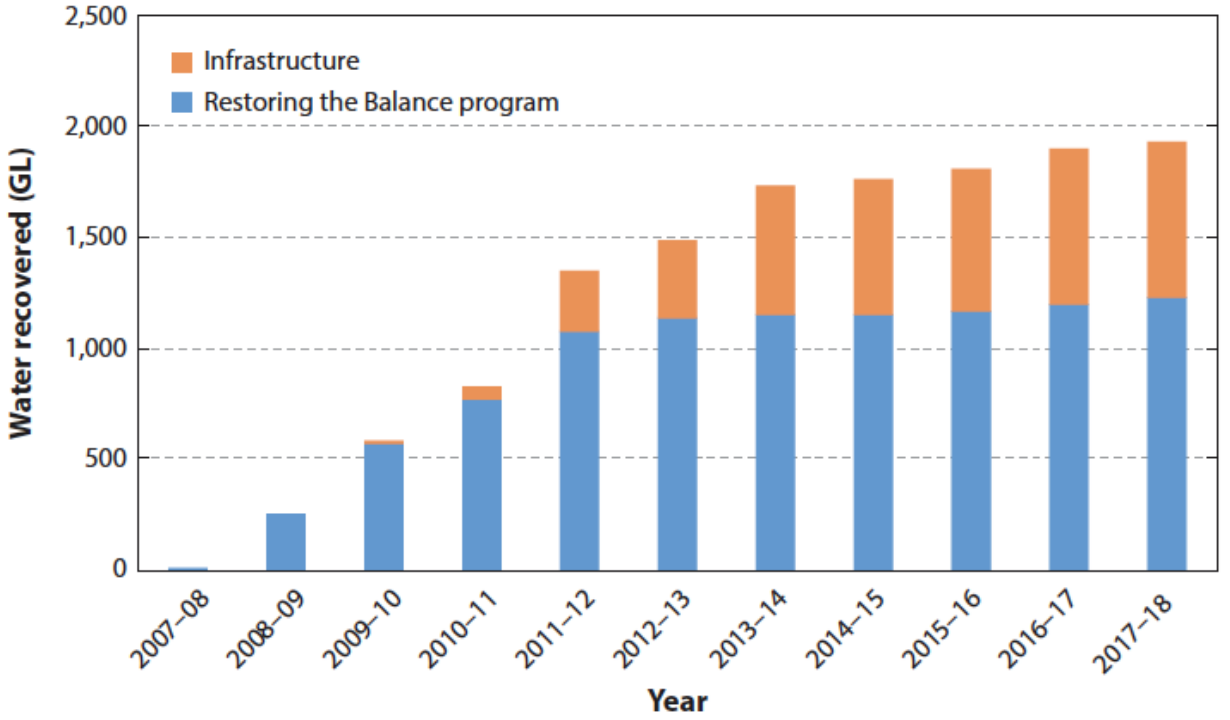
Over 30,000 wetlands, including Ramsar wetlands, important to migratory birds. Wetlands require flow regime that alternates between wet and dry. River Basin supports large agricultural breadbasket with growing diversions for irrigated crops.

Photo: Murray-Darling Basin Authority

Murray-Darling Basin

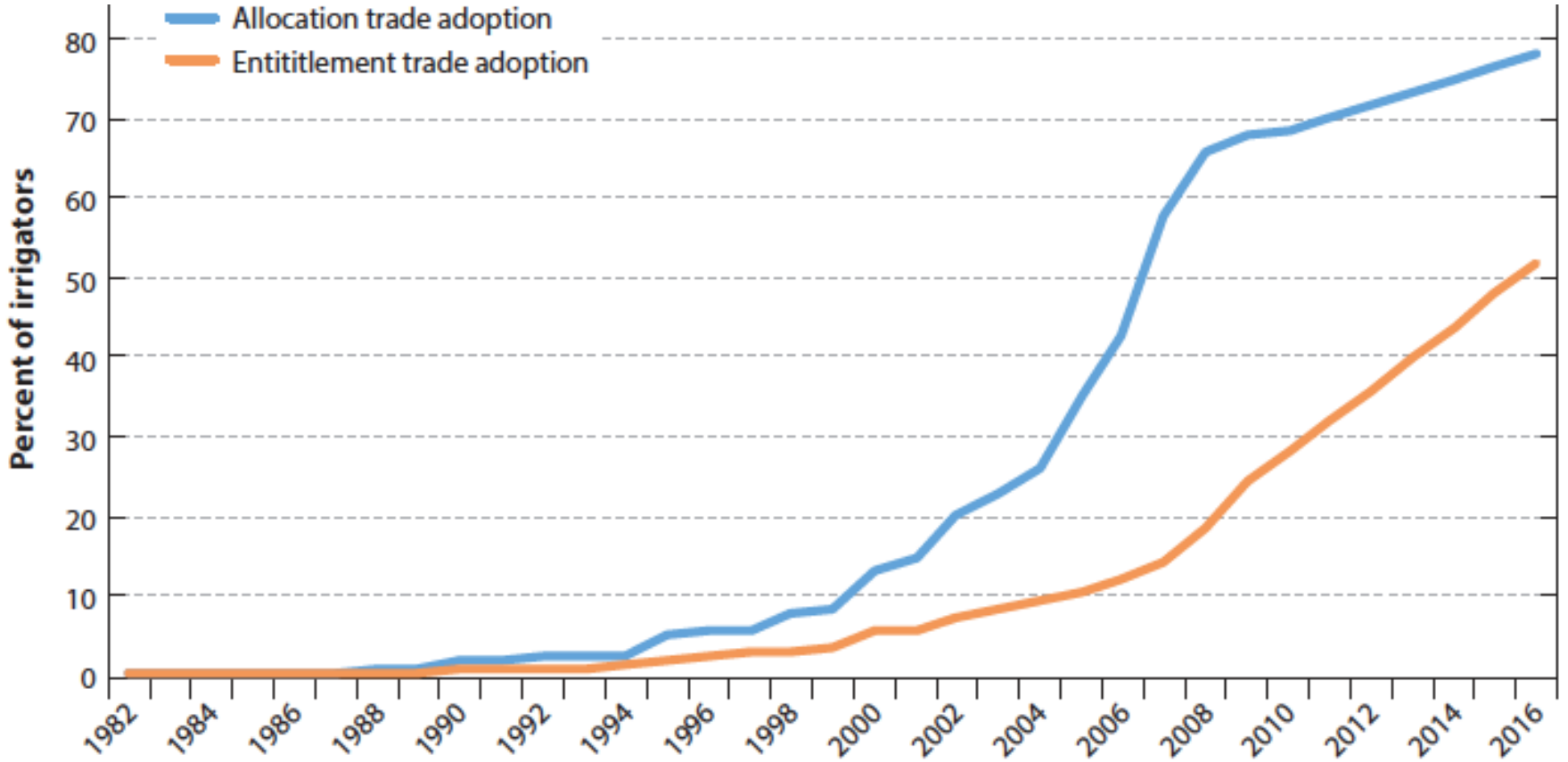
Water recovery for wetland conservation and river function

Water for the Future programme allocated funding for water infrastructure subsidies for improving irrigation efficiency (AUD5.8 billion) and water rights purchases (AUD3.1 billion). The voluntary buy-back of water rights from willing sellers was intended for the environment.



Grafton, R.Q. and Wheeler, S.A., 2018. Economics of water recovery in the Murray-Darling Basin, Australia. *Annual Review of Resource Economics*, *10*, pp.487-510

Percentage of irrigators in the Southern Murray-Darling Basin that have used short-term water markets (blue line) or permanent water markets (orange line) once. What explains this?



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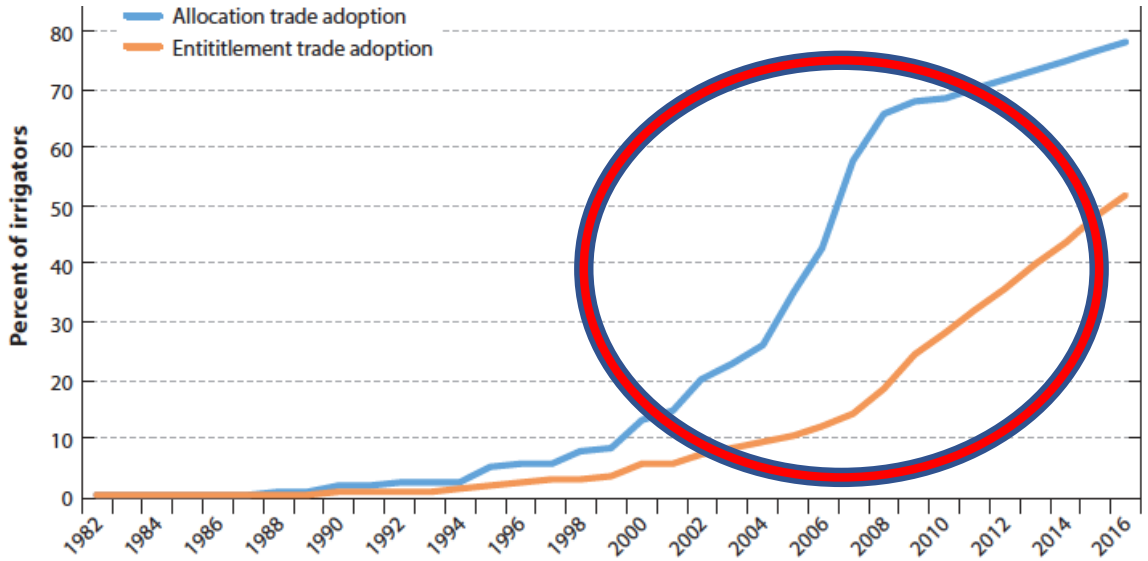
What explains this?

- 2000s Australian Drought – less water supply
- Political Strategy to reform water rights:

- 1880s: Australia nationalized water rights. They became administrative permits that could be changed at will.
- 1990s: A cap/limit on water diversions in the Murray-Darling Basin.
- 1990s: The Government required water districts to distribute water rights to individual water users.
- 2000s: A National Law changed water rights from a right to an absolute amount to a system of proportional shares.
- 2000s: It created an agency to act as a holder of environmental rights.



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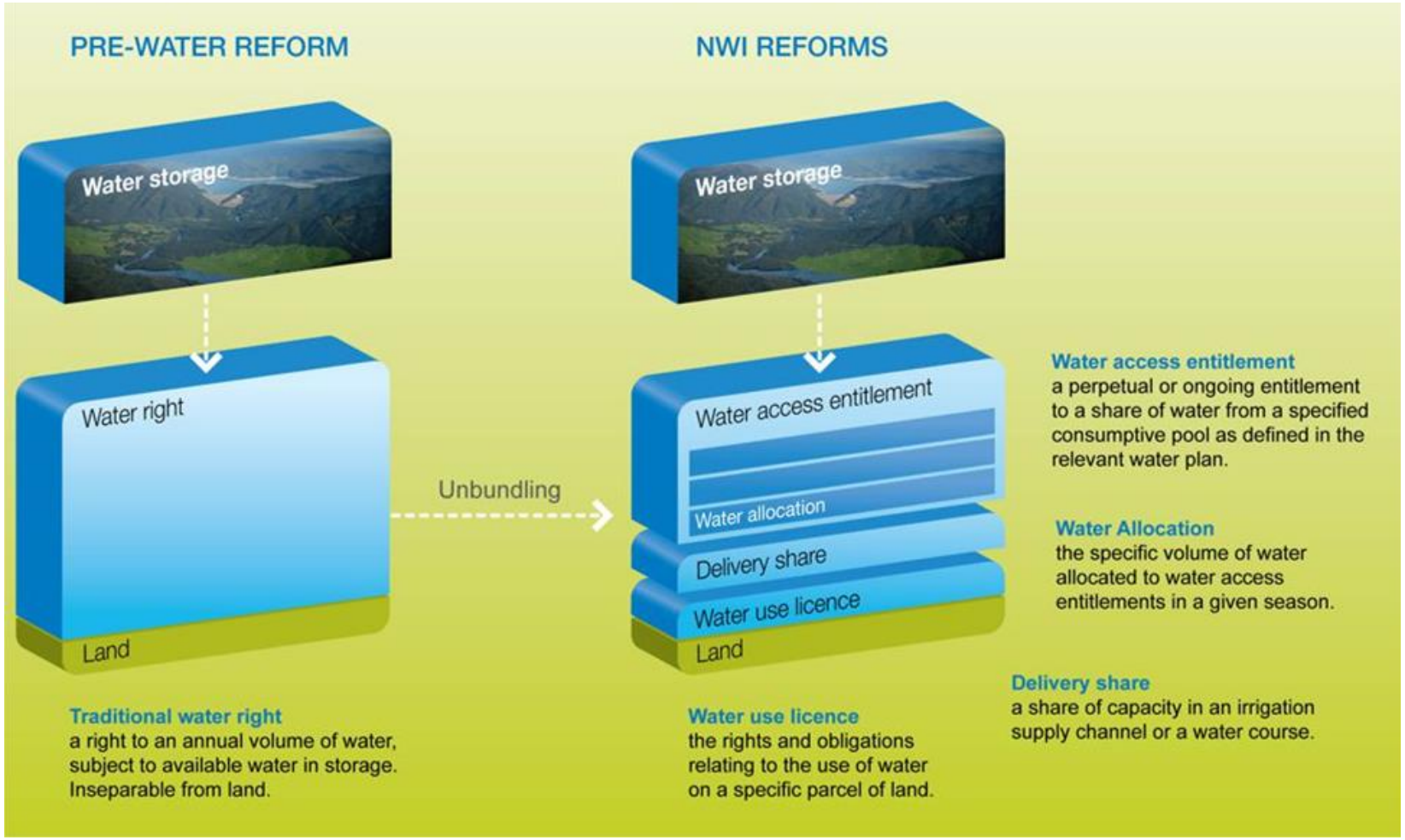
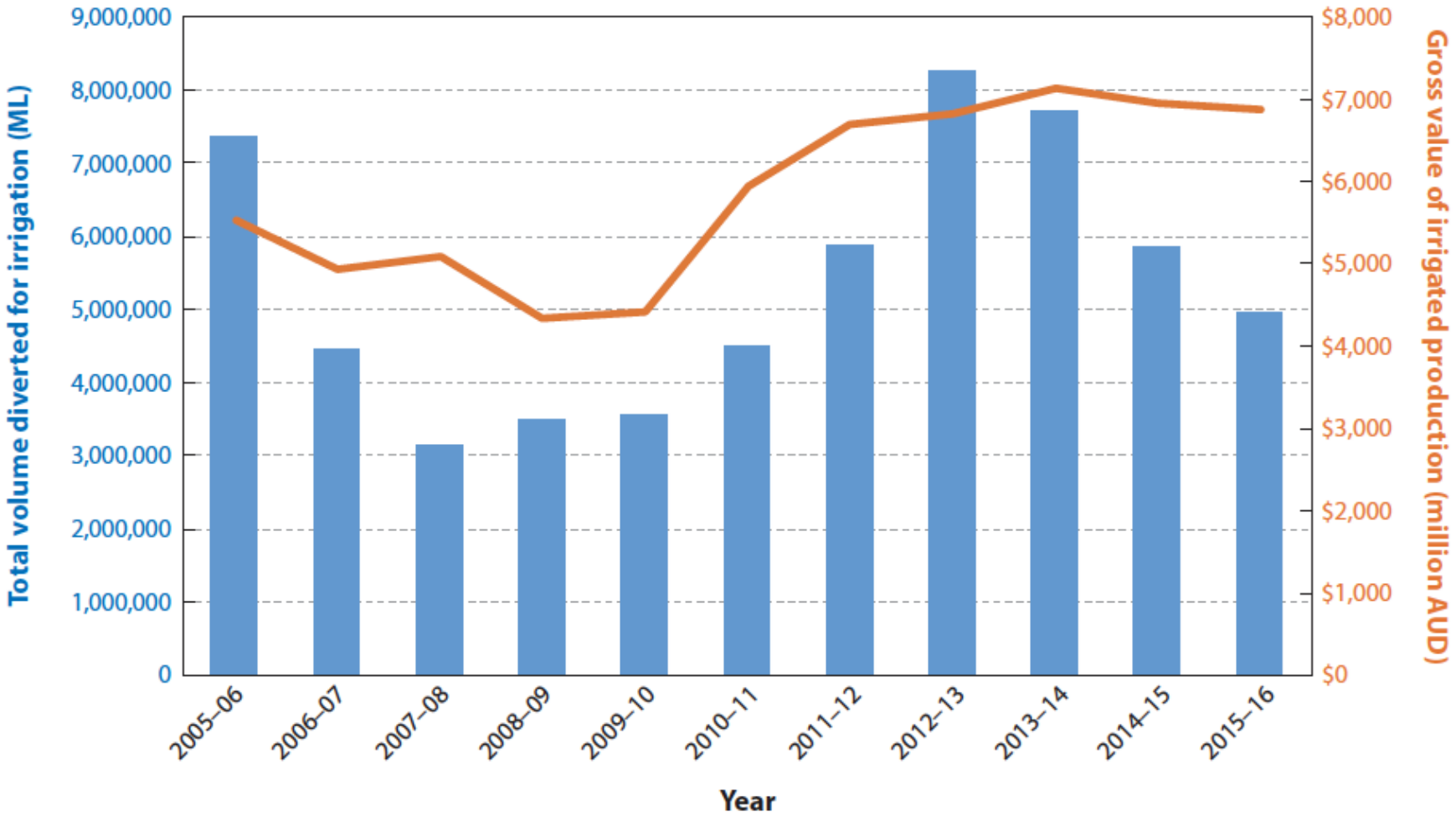
Water Rights Reform
Elements or bundles of rights



Australian National Water Commission, 2011

Murray-Darling Basin

Irrigation water diversion varies with water availability

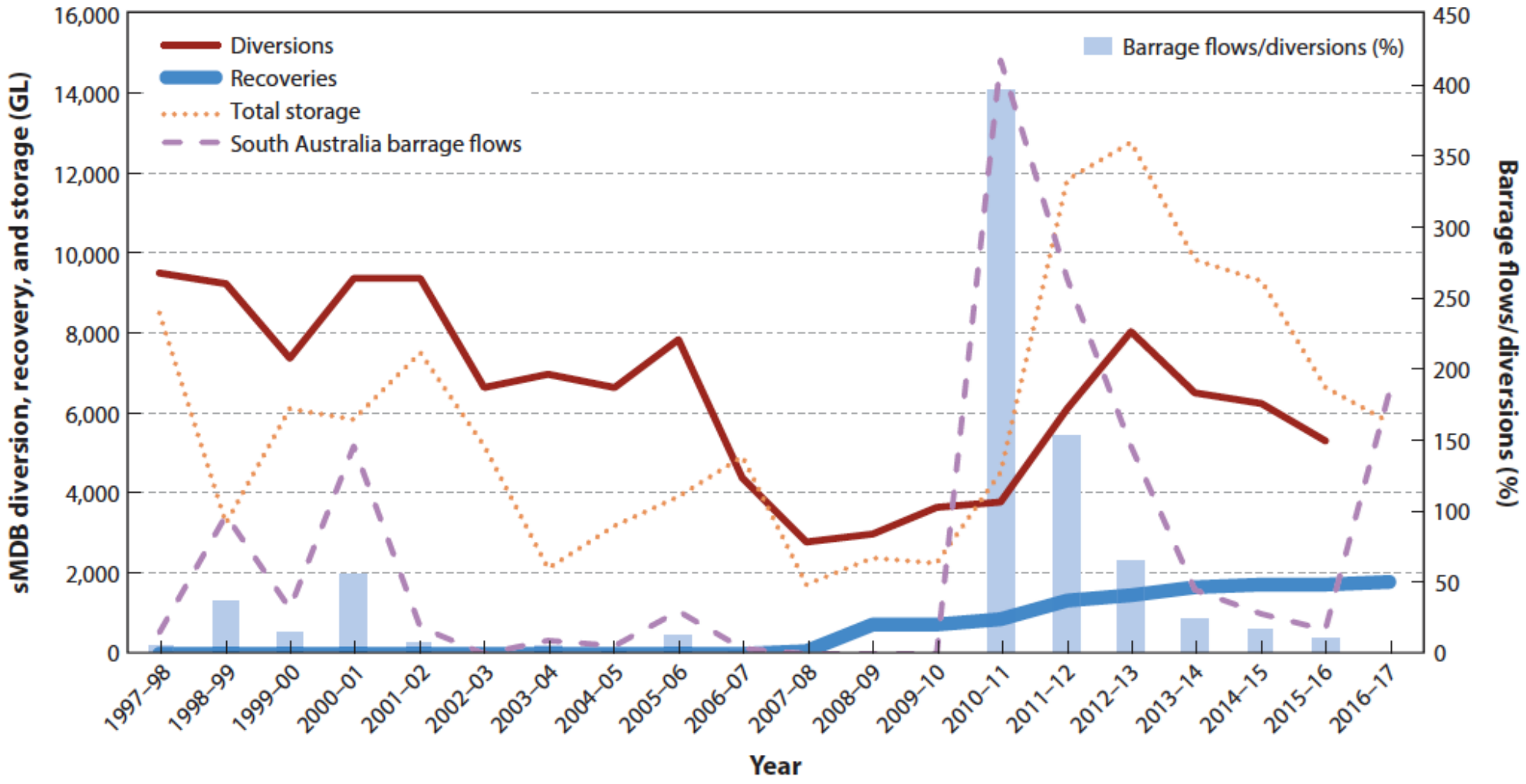


Water market buffers drought and water variability: 2000–2008 the real adjusted gross value of irrigated production fell by just 10%, despite a 70% decline in irrigated surface-water use

Grafton, R.Q. and Wheeler, S.A., 2018. Economics of water recovery in the Murray-Darling Basin, Australia. *Annual Review of Resource Economics*, *10*, pp.487-510

Murray-Darling Basin

Relationship between basin-wide diversions and water recovery unclear



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Why do water markets flourish in the southern but not in the Northern parts of the Basin?

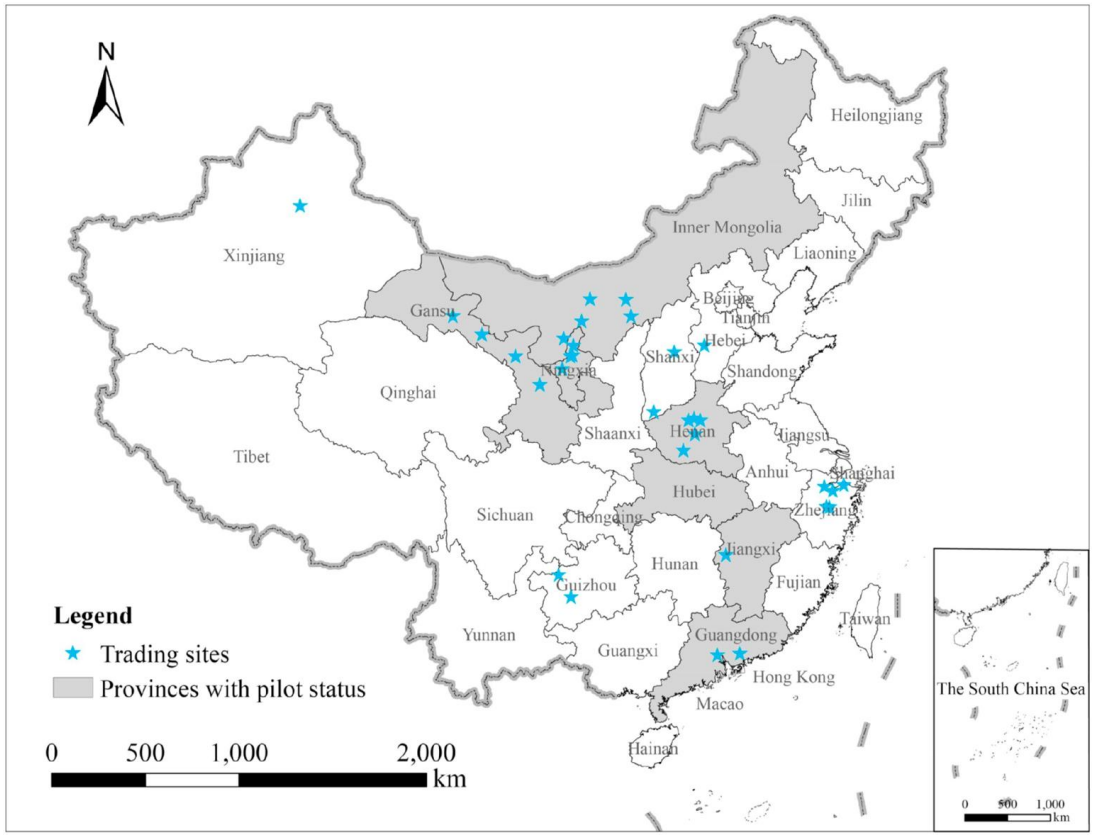
Key fundamental market assessors	Northern	Southern
Property rights/institutions		
1. Water legislation	✓	✓
2. Unbundled rights	✓	✓
3. Rights transferable	X	✓
4. Rights enforceable	✓	✓
5. Constraints between connected systems	✓	✓
Hydrology		
1. Documented hydrology system	✓	✓
2. Understanding of connected systems	✓	✓
3. Future impacts modelled	✓	✓
4. Trade impacts understood	X	✓
5. Resource constraints understood	✓	✓
6. Resource constraints enforced (e.g. existence of a cap)	X	✓
Externalities/governance		
1. Strong governance impartiality	X	✓
2. Existence of externalities understood	X	✓
3. Water-use monitored	X	✓
4. Water-use enforced	X	✓
System type		
1. Suitability of water sources for trade	X	✓
2. Transfer infrastructure availability/suitability	✓	✓
3. Regulation requirements for trade	X	✓
Adjustment		
1. Gains from trade (no. users/transaction costs/diversity of use)	X	✓
2. Political acceptability of trade	X	✓
Entitlement registers and accounting		
1. Trustworthy systems	X	✓
2. Trade and market information availability	✓	✓

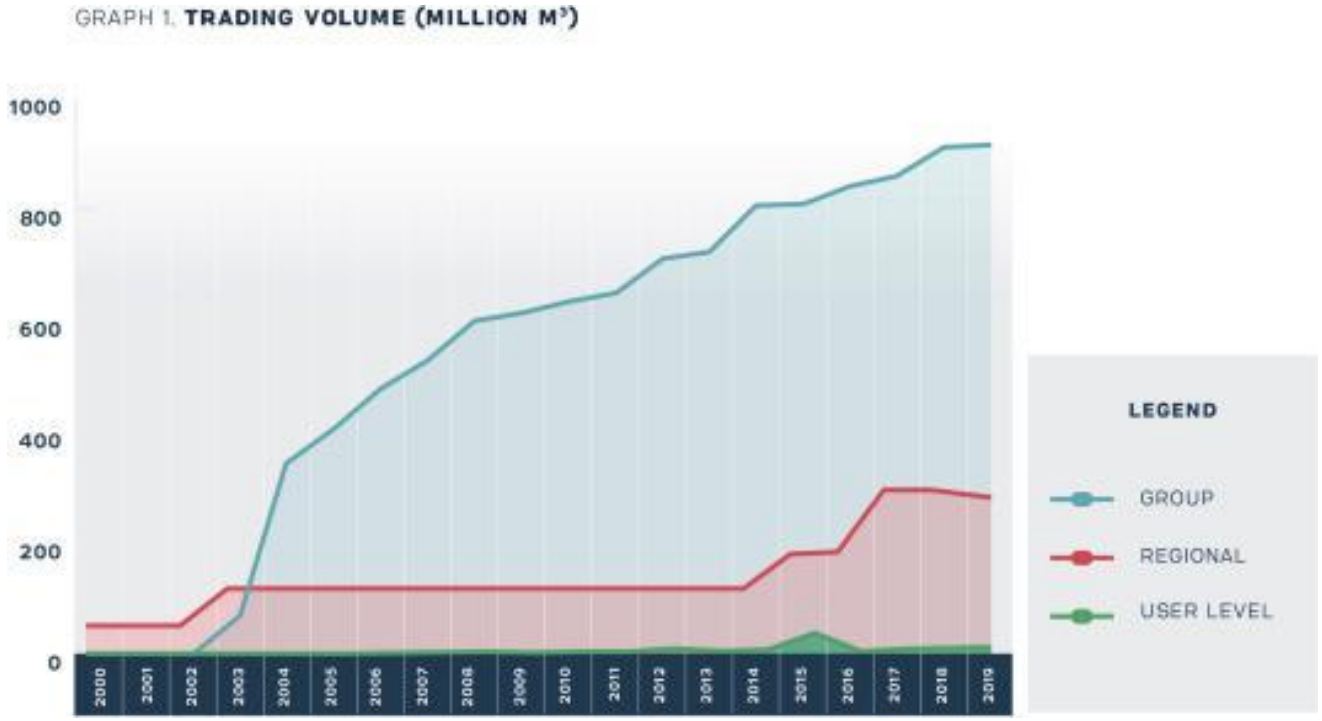
Note: An **X** indicates further reform required for that issue in the particular regional example; ✓ indicates that there is good evidence supporting that particular part of the assessment; while a smaller ✓ indicates that there is positive but limited evidence, and thus room for improvement.

Garrick, D. and Wheeler, S.A., 2020. A tale of two water markets in Australia: lessons for understanding participation in formal water markets. *Oxford Review of Economic Policy, Volume 36, Number 1, pp. 132-153.*

How does hybrid water governance work?

Examining water rights trading in China (2000-2019).





Svensson, J., Wang, Y., Garrick, D., Dai, X., 2021. How does hybrid environmental governance work? Examining water rights trading in China (2000-2019). Journal of Environmental Management. https://doi.org/10.1016/j.jenvman.2021.112333

China: a diversity of water market arrangements

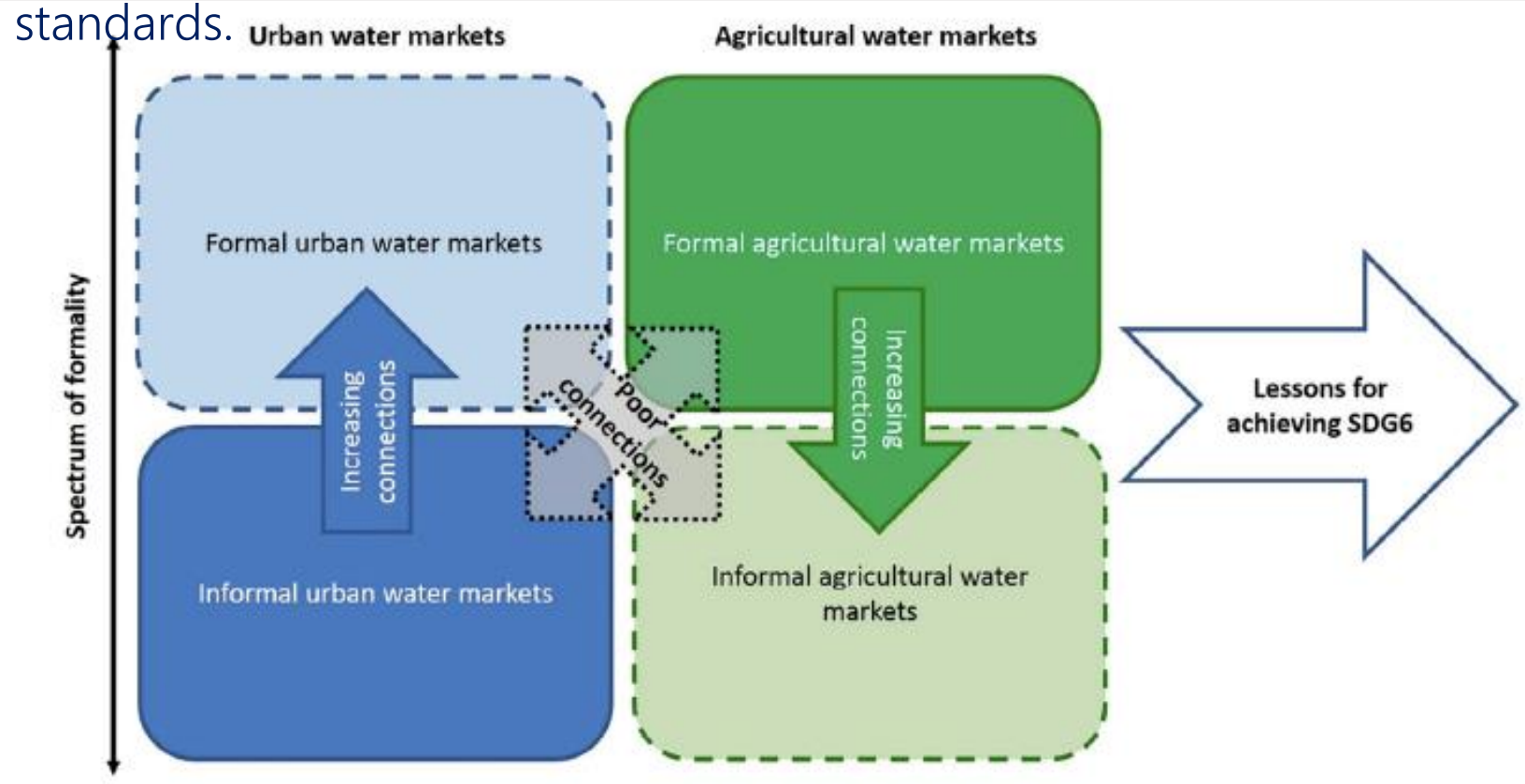
1. **Agricultural water markets, Gansu province:** there can be water markets **with** privatization of water entitlements to individual farmers. **Capped prices** – farmers allowed to bargain up to a limit.

2. **Rural-to-Urban water markets, Inner Mongolia province:** there can be water markets ***without*** privatization of water entitlements to individual farmers. Instead, local state control of water rights. **Market prices** – the seller and buyer can decide the price.

3. **Urban-to-Urban water markets, Henan province:** there can be water markets ***without*** allowance for profit to be made. **Fixed prices** – the buyer pays the seller's cost with no profit markup.

Summary: Moving beyond the formal and informal divide

In *practice*, almost all water markets involve a mixture of formal and informal characteristics in terms of property rights, price regulation and quality standards.



O'Donnell, E. and Garrick, D. 2019. The diversity of water markets: Prospects and perils for the SDG agenda. WILEY, pp. 1-24.

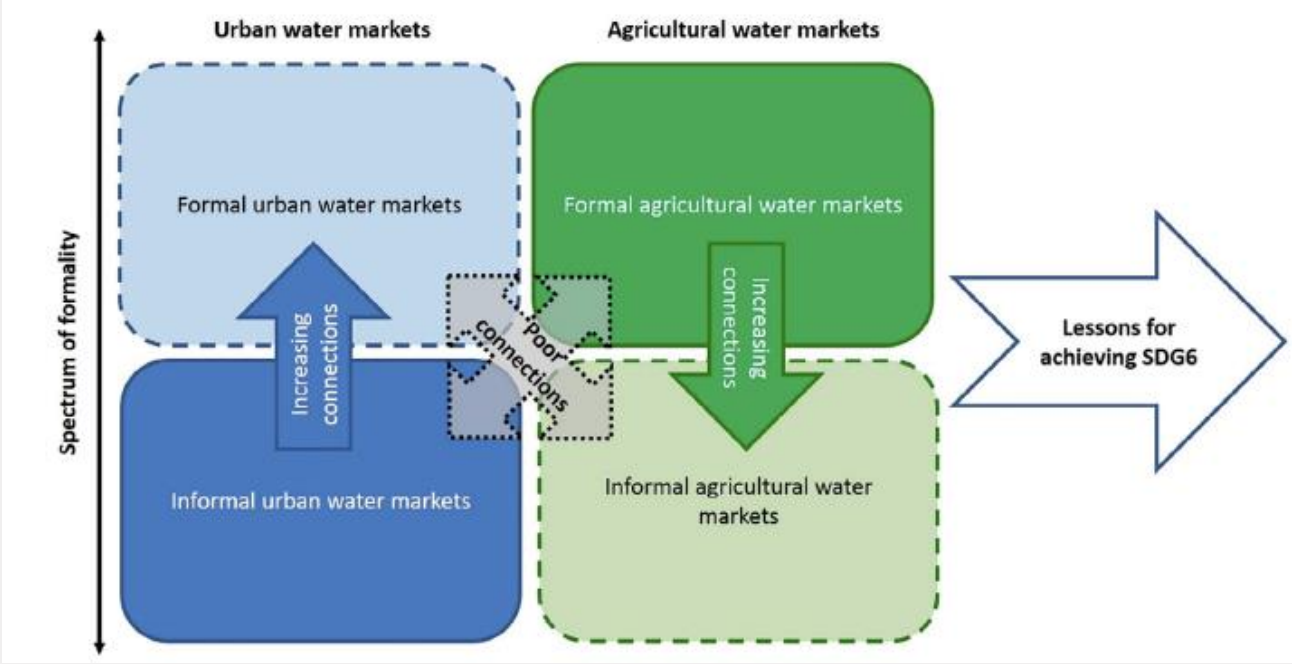
Summary: lessons on the role water markets can play in achieving SDG 6

1. Water markets can have a positive or negative impact on four targets of SDG6:

- Safe, accessible, affordable water supplies (SDG 6.1; 6.3)
- Efficient allocation and use of water (SDG 6.4)
- Environmental sustainability (SDG 6.4) and the health of water ecosystems (SDG 6.6) and
- Appropriate regulation and community participation (SDG 6A, 6B)

2. But the impact will depend on appropriate regulation and governance.

3. Growing water scarcity + increasing urban water demand will keep driving the development of water markets.



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Markets and the water commons: What types of markets have developed and what types of problems do they try to address? Why have formal water markets struggled, but informal markets proliferated? How are markets related to other policies and institutions for governing water?

Mapping Hotspots

Drivers of resource scarcity

- Climate risks
- Urbanisation
- Market integration
- Water scarcity

Risks

Identifying Blind spots

Understanding environmental conflicts

- Human-environmental
- Rural-urban
- Cultural values
- Transboundary

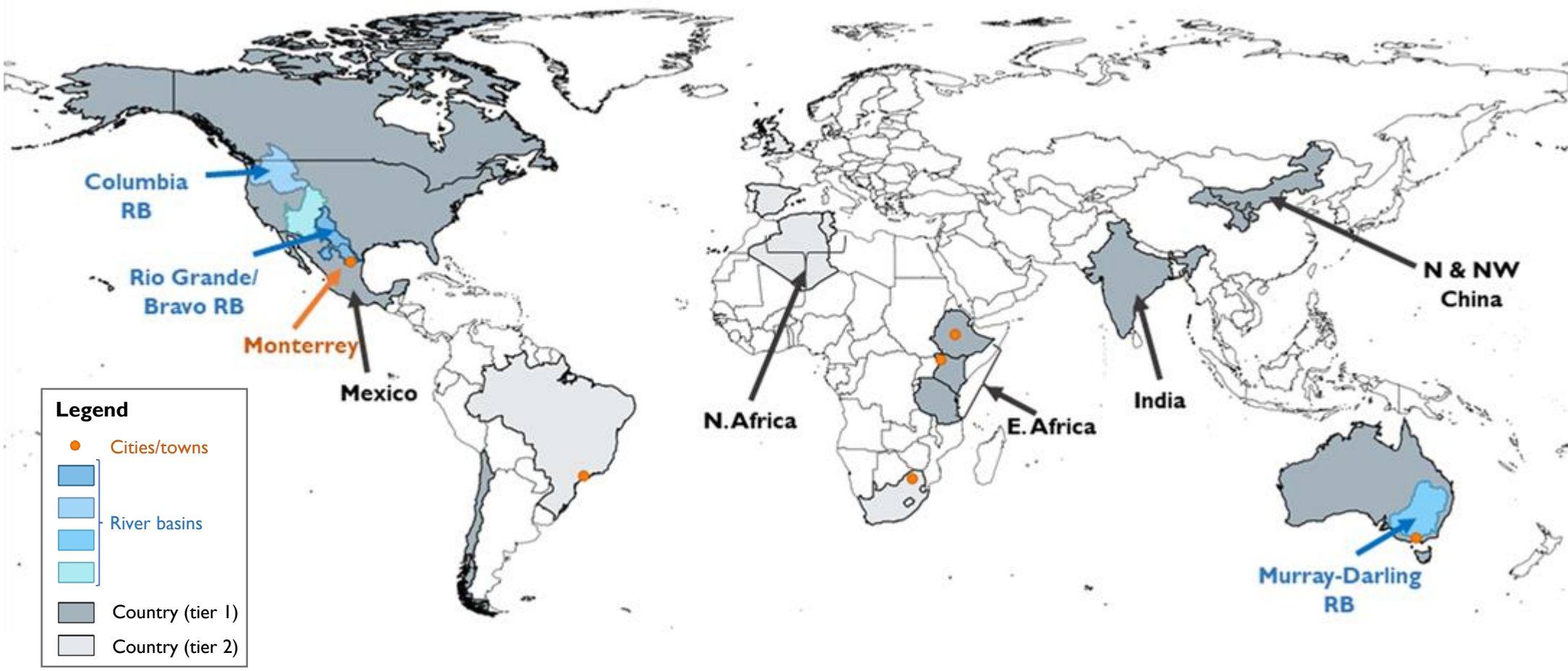
Values

Assessing Pathways

Markets & the Commons

- Institutional Design
- Property rights
- Incentives
- Political economy
- Performance assessment

Governance



GCRF Global Challenges Research Fund

NEWAVE

THE WORLD BANK

The Nature Conservancy

National Fish and Wildlife Foundation

Global Project on Assessing Water Markets

Summary: Key messages

1. Markets are institutions, and all institutions are imperfect. Not *inherently* bad, and should be compared to the alternatives (e.g. the need to finance large-scale, centrally-operated water supply infrastructure).

2. Water markets are *neither free nor self-enforcing*. They are dependent on both the role of the government and the role of the community. In short, water markets are not masters but servants of good governance.

3. Is privatization inevitable? No, property rights to water in markets are *never fully privatised*, and need not be formalized. Almost always individual water rights conditioned by collective rights and duties held by groups and the Government.

4. The constraint that blocks having more effective water markets is a failure to solve the political constraints of reforming water rights.

5. Water markets are *more prevalent and diverse* than commonly recognized. But naïve and dangerous ideas still dominate many discussions, who see markets in black and white, but without a

Thank you!