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# **Water property rights in rivers with large environmental water holders**

Neal Hughes

Contributed presentation at the 60th AARES Annual Conference,  
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# Water property rights in rivers with large environmental water holders

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# Motivation

Water is a complex commodity

- Non-rivalries, non-linearities, climatic uncertainty
- First best property rights outcome not possible
- Externalities and transaction costs always persist

How to define property rights to:

- Water flows
- Storage capacity

A computational experiment...

- Develop a model of a river system with many users
- Impose different property right systems

# Environmental water

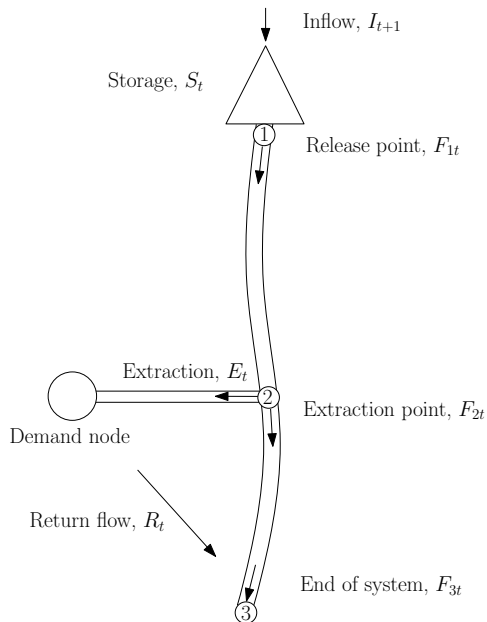
## Environmental water holders (EWH)

- Acquire water rights from farmers, use them for environmental flows
- hold storage reserves and engage in spot market
- Typically large relative to farmers
- Commonwealth Environmental Water Holder (CEWH) in the MDB

## Concerns...

- Externalities
- Market power

# The model



# The model

## Solving the model...

- A stochastic game
- Multi-agent reinforcement learning
- Parallel computing, ANU NCI supercomputer

## Parameter distributions...

- Supply side based on 22 major dams in the MDB
- Demand side based on ABARES irrigation survey data
  - ▶ 100 users divided into two groups (i.e., broadacre and horticulture)
- Environmental objective: minimise deviation from natural flows

# The model

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# Water property right scenarios

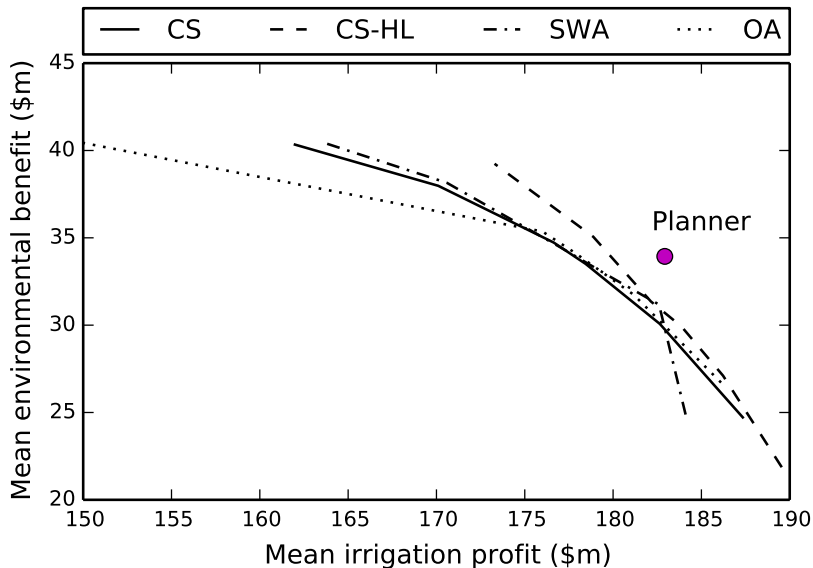
## Storage capacity

- No storage rights (NS)
- Capacity sharing (CS)
- Spill forfeit rules (SWA)
- Open access (OA)

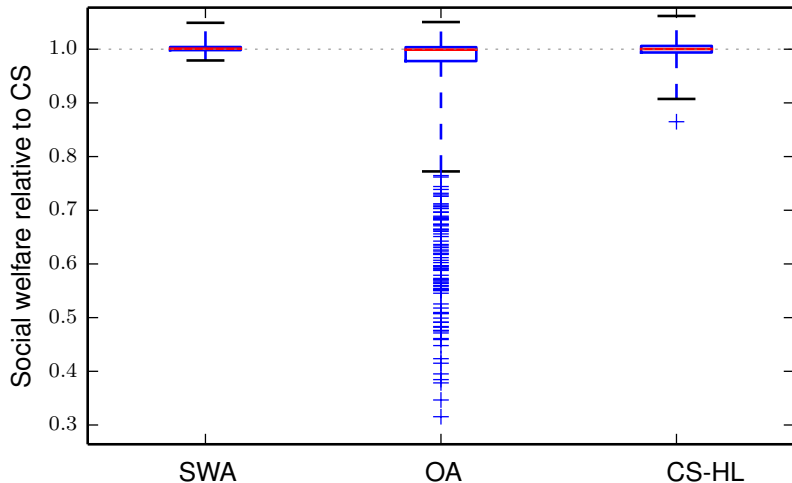
## Water flows

- Proportional rights
- Priority rights (HL)

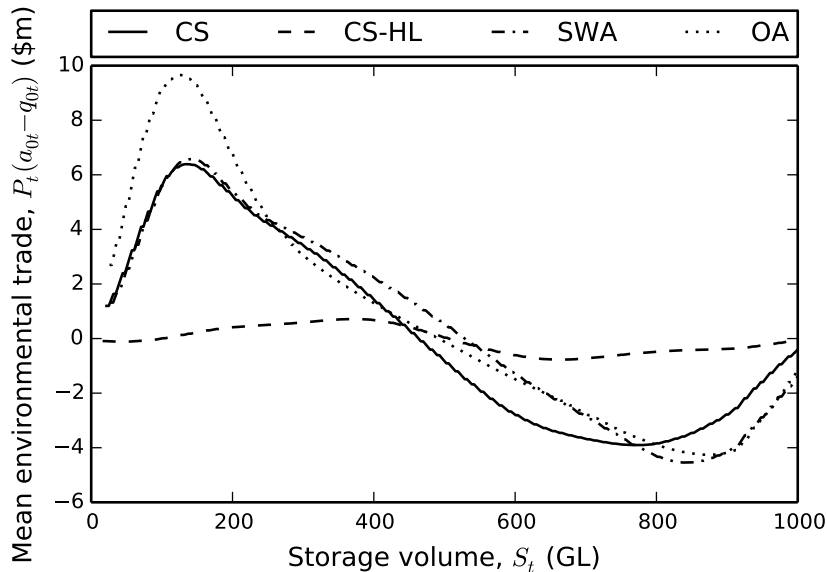
## Results: central case: trade-off curves



## Results: general case: mean welfare relative to CS



## Results: central case: EWH trade position



# Conclusions

## Storage rights

- OA leads to over-storage, NS to under-storage
- CS is the best approach overall
- Implications for the MDB...

## Flow rights

- With no EWH priority rights make things worse
- With an EWH there are large gains from counter cyclical trade
- Priority rights can reduce trade requirements
- Implications for the MDB...

# Thanks



# A demonstration

Sample time series results [▶ Link](#)