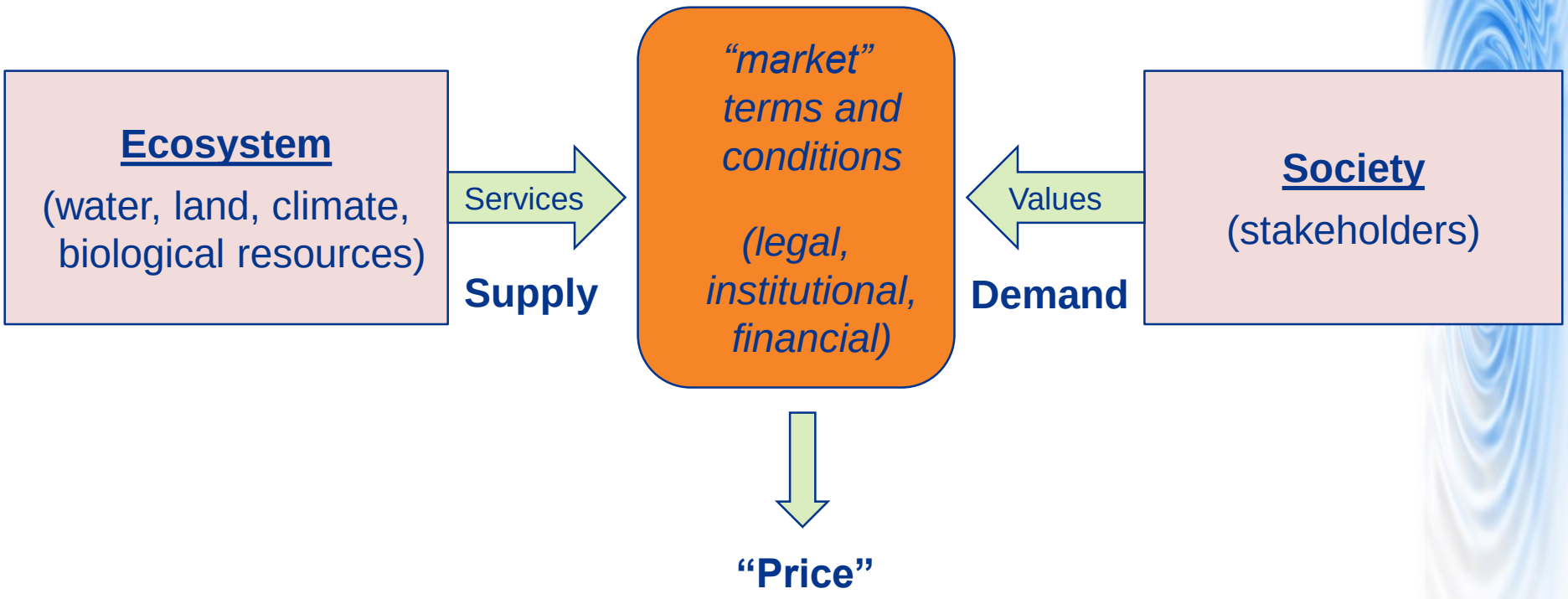
Global Assessment of Institutional-Economic Factors Explaining the Environmental Performance of Payments for Watershed Services

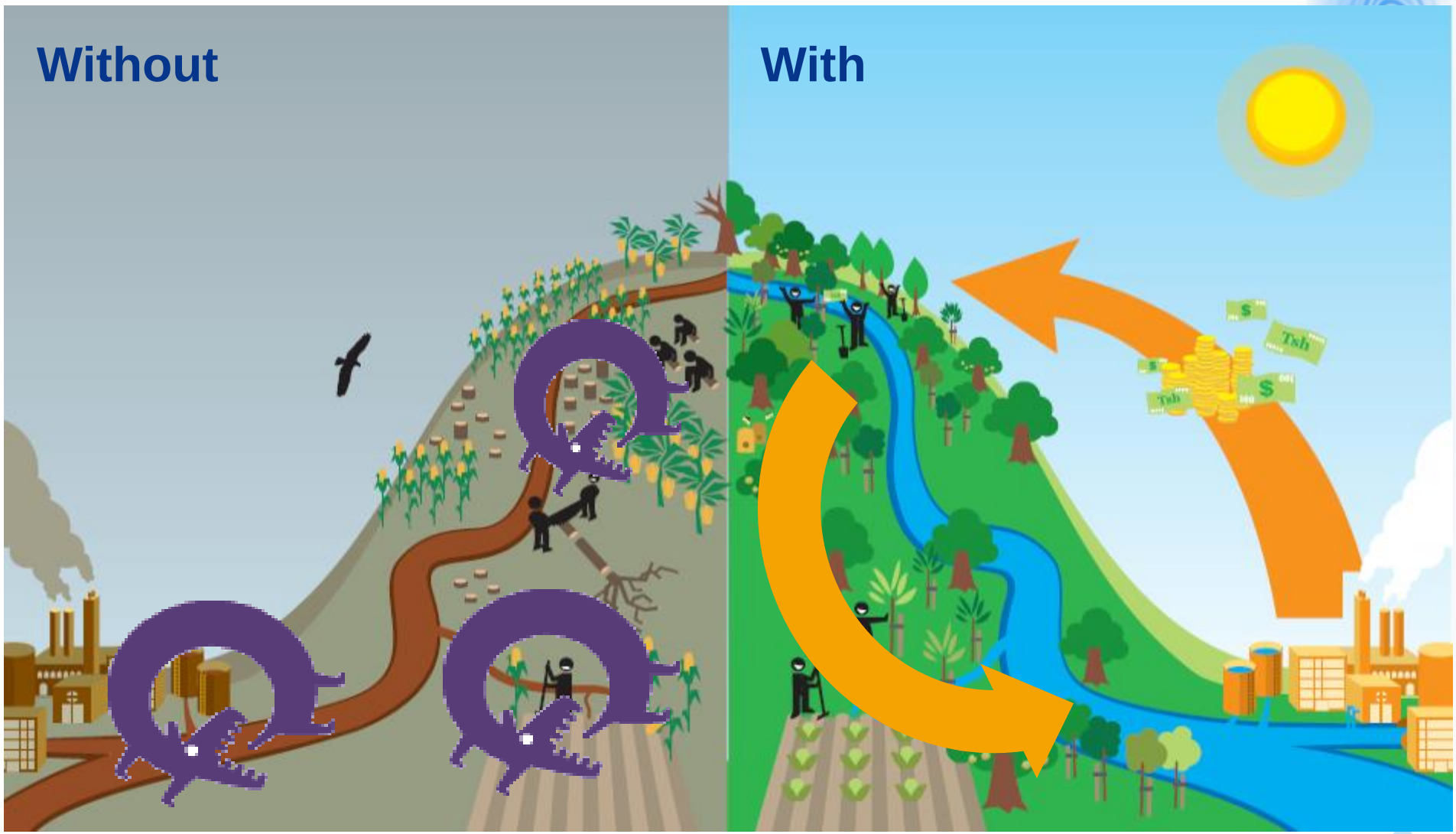
Roy Brouwer

UNIVERSITY OF WATERLOO
the water INSTITUTE
University of Waterloo

Markets as a possible way to coordinate resource allocation



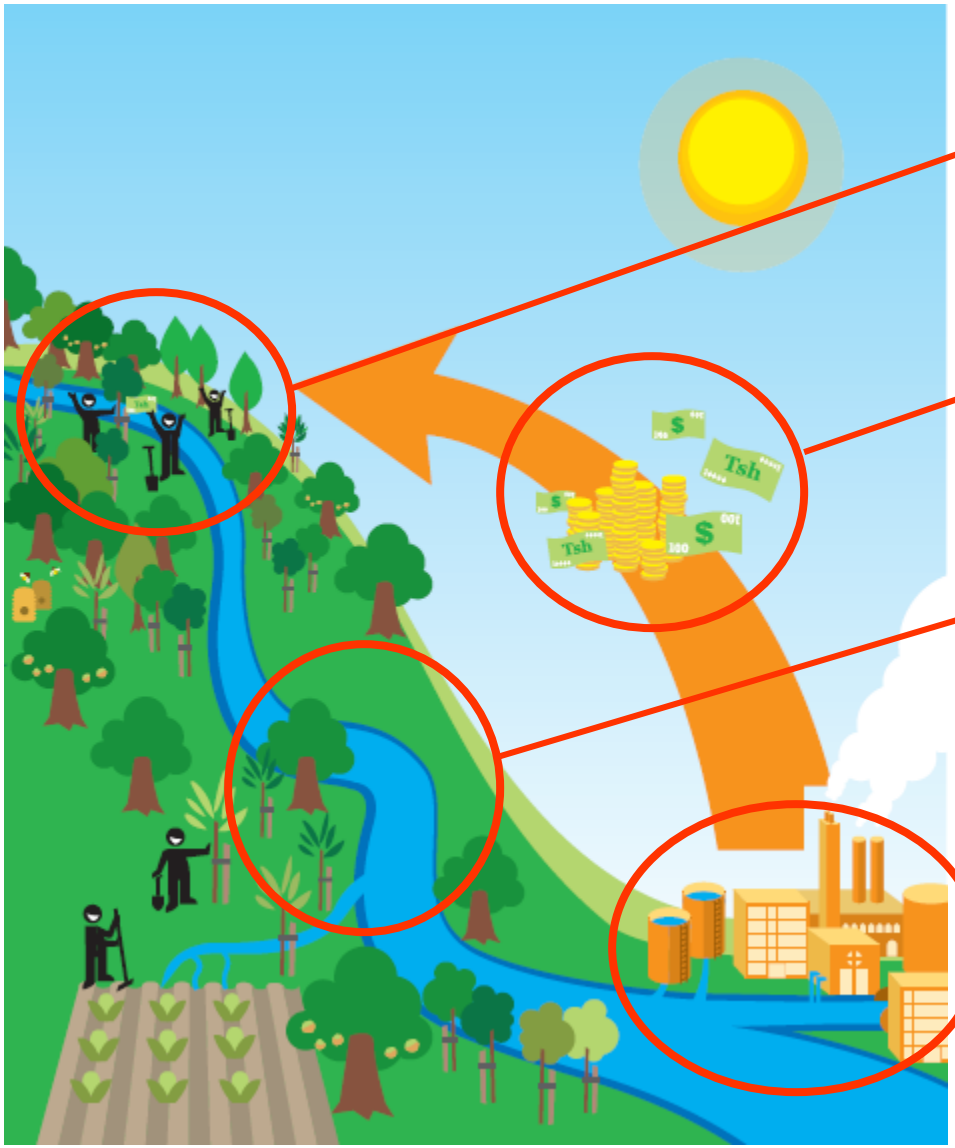
Payments for watershed services



UNIVERSITY OF WATERLOO

the water INSTITUTE
University of Waterloo

What a decision maker needs to know is …



WTA of upstream residents

Institutions & financial mechanisms

Hydrological & carbon assessment

WTP of downstream beneficiaries

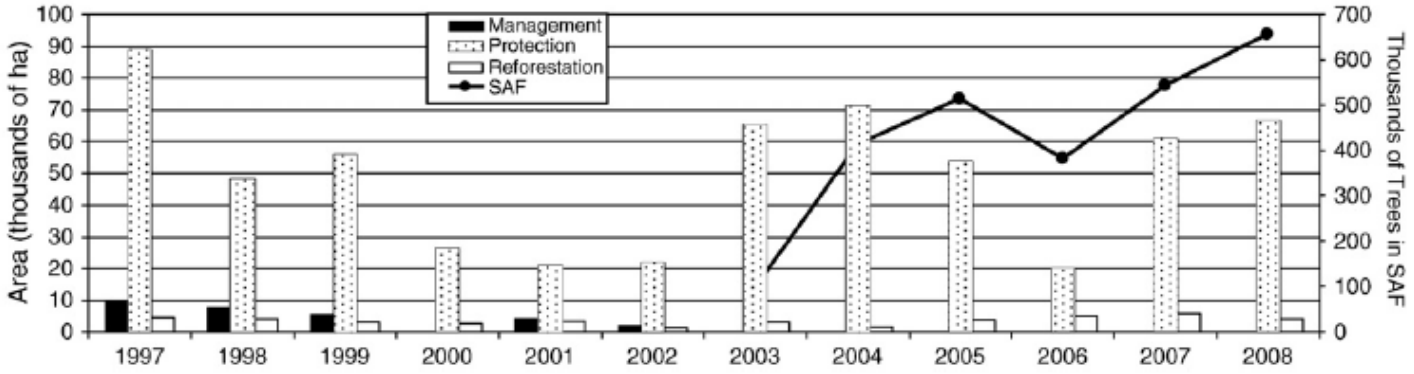
UNIVERSITY OF WATERLOO

the water INSTITUTE
University of Waterloo

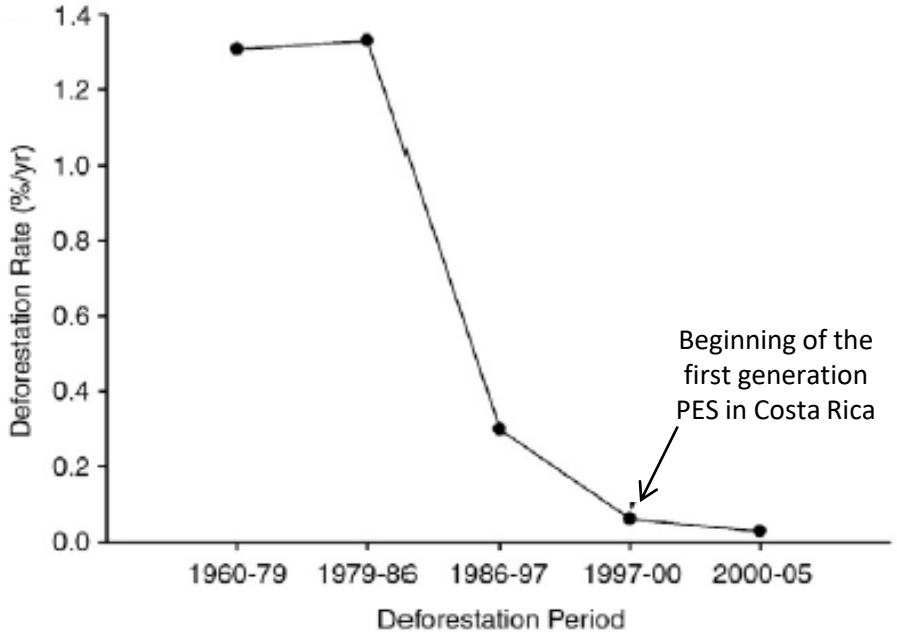
Problem

- Lack of empirical evidence causal relationship institutional design and cost-effectiveness PES
- Many assessments, most reviews of success and fail factors qualitative in nature
  - Engel et al. (2008) *Ecological Economics*
  - Bulte et al. (2008) *Environment and Development Economics*
  - Rebelo (2009) *Journal of Sustainable Forestry*
  - Farley and Costanza (2010) *Ecological Economics*
- Some key issues: *conditionality* (Wunder, 2005) and *additionality* (Daniels et al., 2010)
- Factors that contribute to the functioning of PES schemes often poorly understood

Additionality



SAF: sistema agroforestal



Daniels et al. (2010)

UNIVERSITY OF WATERLOO

the water INSTITUTE University of Waterloo

From the literature

- Impact of multiple objectives on PES efficiency (Bulte et al., 2008)
- User-financed (instead of government financed) better targeted, more adapted to local conditions, better monitoring, greater willingness to enforce conditionality, less confounding side objectives (Wunder et al., 2008)
- Effectiveness depends on various factors:
  - Clarity ES definition (specific vs more general) and beneficiaries who are willing to pay for ES; may not be same as who finances the scheme (Mayrand & Paquin, 2004)
  - Clear enforceable rules & transaction mechanisms, incl. rights and tenure (Greiber, 2009)
  - Effective compliance and enforcement mechanisms (Smith et al., 2006)
  - Costs & benefits ES provision visible and quantifiable (Rojahn & Engel, 2005)
  - Sustainable flow of revenues to maintain land use changes (Pfaff et al., 2008), payments must therefore be ongoing as opposed to one-off (Pagiola and Platais, 2002)
  - Payment method (cash versus non-cash) and periodicity (Wunder, 2005)

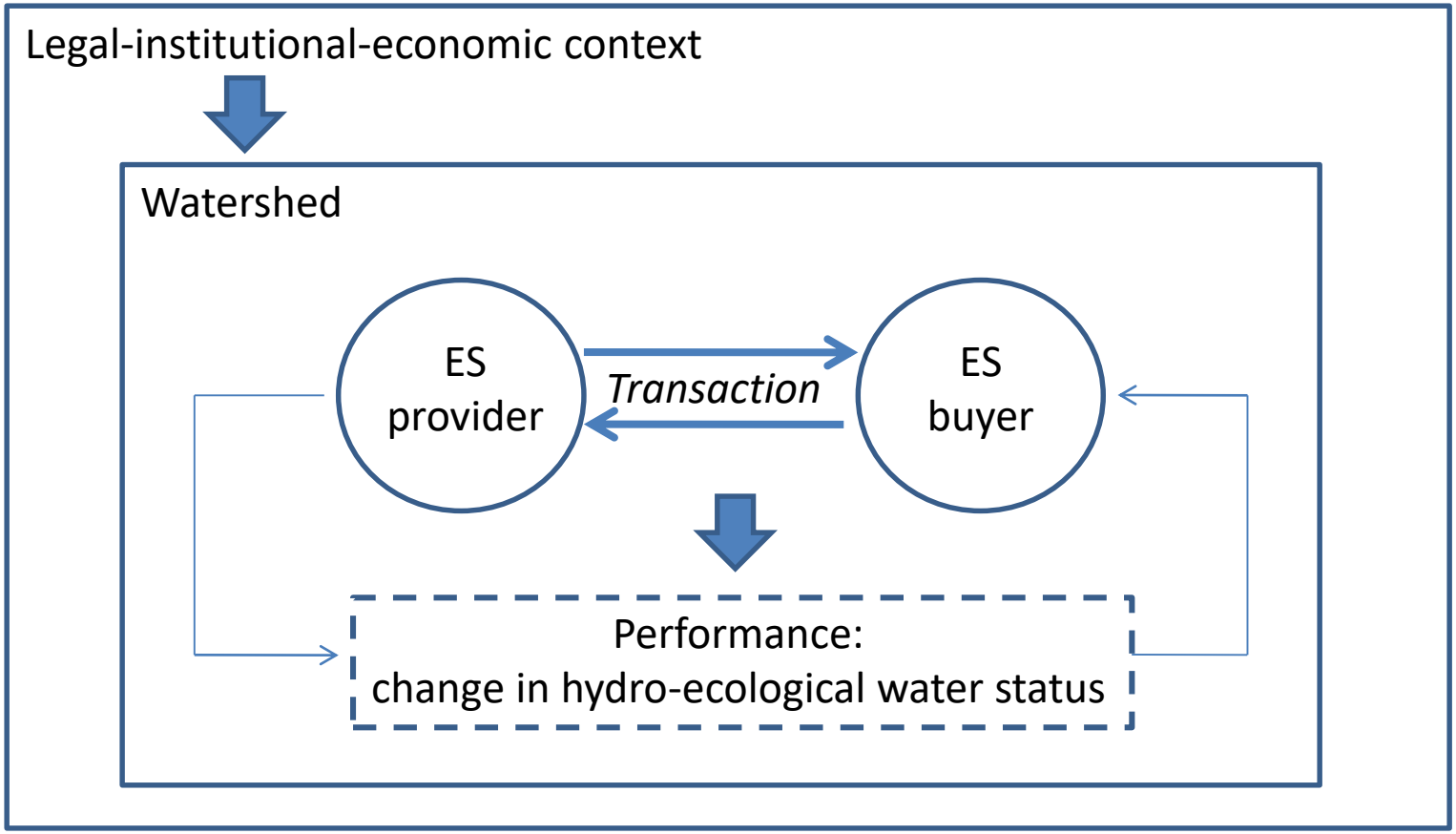
Main objective

- Assessment institutional-economic design factors that drive and explain the environmental performance of existing Payments for Watershed Services (PWS) schemes

Methodological approach

- Meta-analysis: statistical analysis/evaluation of findings of multiple empirical studies, synthesizing results through identification of common effects, often using regression techniques in meta-regression model (e.g. Nelson and Kennedy, 2009)
- Starting point: 50 schemes listed in Porras et al. (2008) and IIED's watershed markets website (www.watershedmarkets.org)
- Additional secondary data sources (reports, policy briefs, websites, and published peer-reviewed scientific literature)
- Questionnaire sent to managers/contacts 52 PWS schemes in Asia, Africa, Central & South America
- Response rate: 38% (16 schemes + additional info for 4)

Conceptual framework



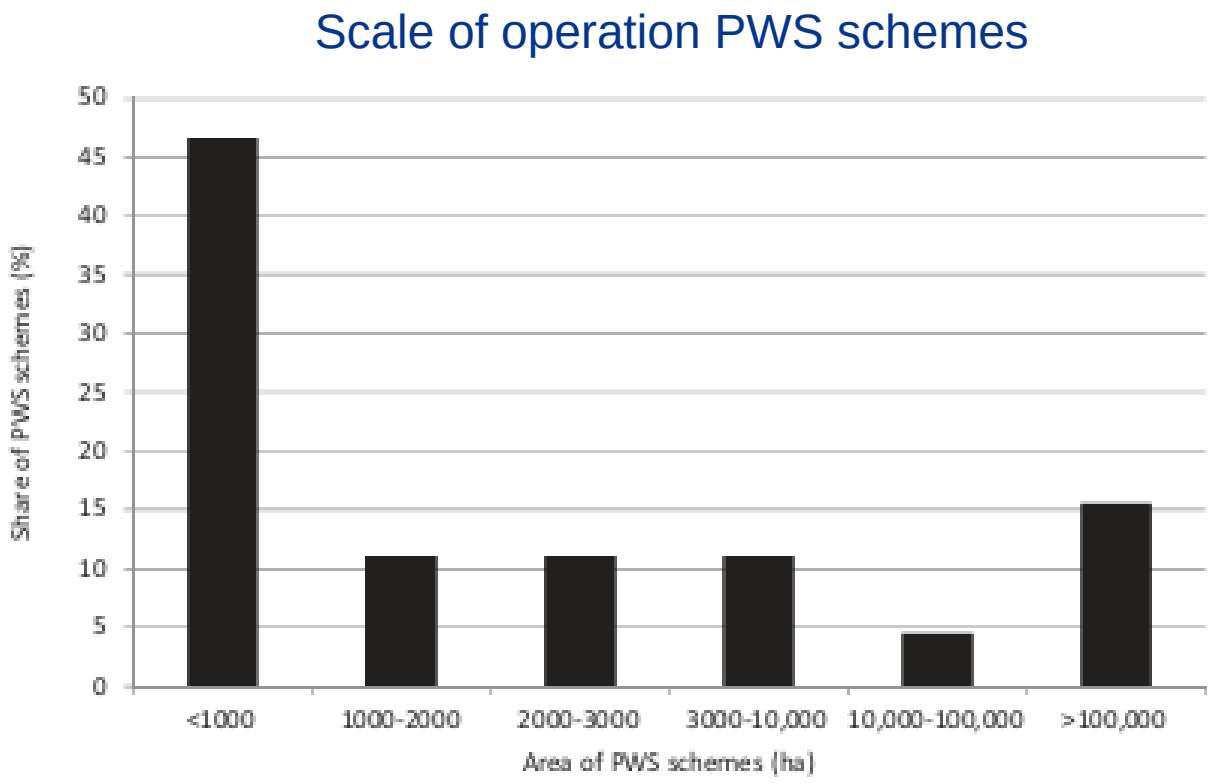
Meta-regression model

- Y = a + b1*__Scheme__ chars + b2*__Players__ + b3*__Participation__ chars + b4*__Payment__ chars + b5*__Compliance__ chars

- Y: effectiveness of PWS scheme in achieving its environmental objectives

Scheme characteristics

- 47 schemes in total, covering 22 million ha of land



UNIVERSITY OF WATERLOO

the water INSTITUTE University of Waterloo

Scheme characteristics

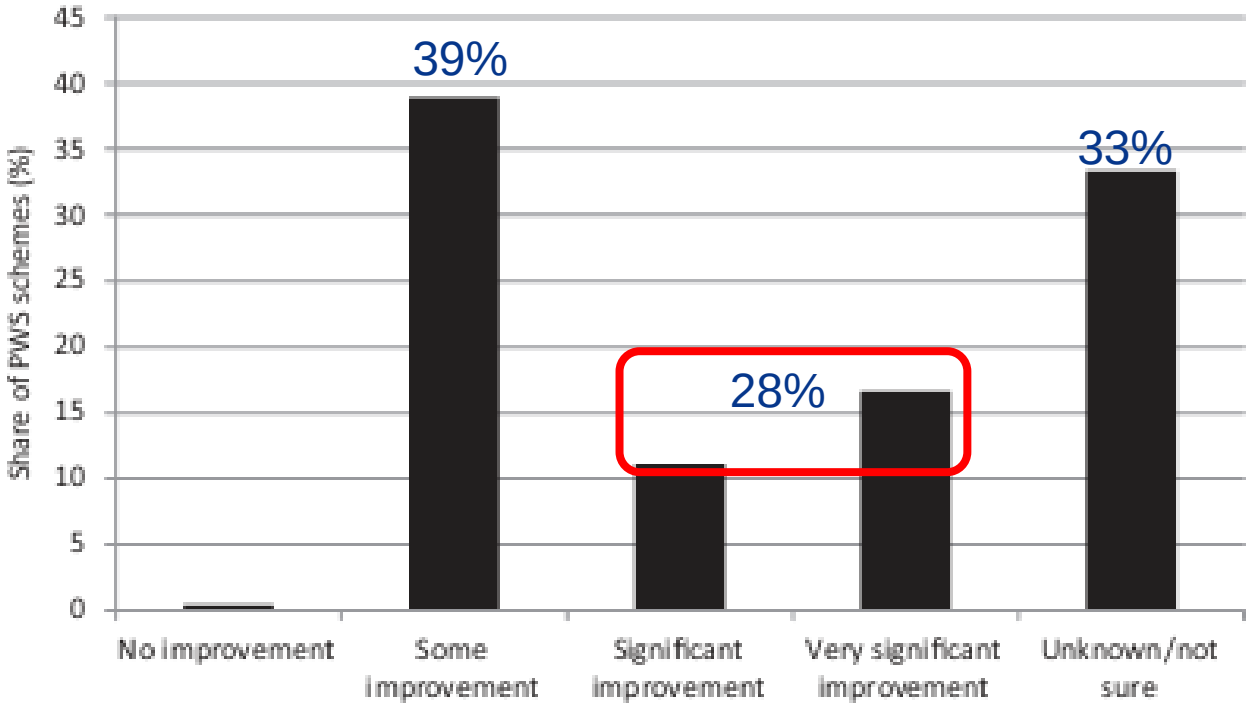
- Most schemes (20) in Central America (e.g. Costa Rica), followed by South America (e.g. Ecuador) and Asia (e.g. Indonesia, Philippines)
- Average age scheme 11 year (4-40), oldest schemes in India
- Drinking water supply most common, followed by sedimentation reduction or combination, irrigation, and general watershed protection
- PWS in most cases voluntary (79%) by private forest owners (53%) or farmers (34%), sometimes operating as a community
- Downstream water users (28%), national govt (25%), local municipality (19%), private company (21%)

Scheme characteristics

- 30% implemented at national scale, rest at local/regional level
- 2/3 of the schemes have quantitative objectives, however, quantified measurements are largely lacking
- Monitoring limited to 27 of the 47 PWS schemes (57%)
- Hence only 47% monitored quantitative objectives
- In 70% of the cases most important environmental indicator was land covered with forest
- 58% of the schemes classified as effective in reaching their environmental objectives, i.e. ES provision (conditionality)
- Cross-check with self-reported effectiveness

Scheme characteristics

Self-reported PWS contribution to environmental quality improvement



UNIVERSITY OF WATERLOO

the water INSTITUTE University of Waterloo

Results

Variable	*Description*	*Coefficient estimate*	*Standard error*	*p*
Constant	-	3.807	2.089	0.068
General scheme characteristics				
	Dummy: 1 = PWS scheme is older than 10 years	1.472	0.972	0.130
	Dummy: 1 = PWS scheme is implemented at national level	-0.135	0.935	0.885
Players involved				
	Dummy: 1 = ES provider is private forest owner	0.964	0.912	0.290
	Dummy: 1 = ES users are downstream drinking water consumers	-0.155	0.979	0.874
	Dummy: 1 = ES users are downstream hydropower companies	4.513	2.347	0.054
	Number of intermediaries	-2.896	1.294	0.025
Nature of scheme participation				
	Dummy: 1 = Voluntary participation	-4.444	1.879	0.018
	Dummy: 1 = PWS contract is with whole community	2.858	1.476	0.053
Payment characteristics				
	Dummy: 1 = Payment of ES provider is in cash	1.994	1.193	0.095
Scheme compliance/enforcement				
	Dummy: 1 = ES providers are selected based on criteria	-2.487	1.167	0.033
	Dummy: 1 = Monitoring of quantified environmental objectives	1.403	0.819	0.086

N=47

R^2=0.47

Results

Variable	*Description*	*Coefficient estimate*	*Standard error*	*p*
Constant	-	3.807	2.089	0.068
General scheme characteristics				
	Dummy: 1 = PWS scheme is older than 10 years	1.472	0.972	0.130
	Dummy: 1 = PWS scheme is implemented at national level	-0.135	0.935	0.885
Players involved				
	Dummy: 1 = ES provider is private forest owner	0.964	0.912	0.290
	Dummy: 1 = ES users are downstream drinking water consumers	-0.155	0.979	0.874
	Dummy: 1 = ES users are downstream hydropower companies	4.513	2.347	0.054
	Number of intermediaries	-2.896	1.294	0.025
Nature of scheme participation				
	Dummy: 1 = Voluntary participation	-4.444	1.879	0.018
	Dummy: 1 = PWS contract is with whole community	2.858	1.476	0.053
Payment characteristics				
	Dummy: 1 = Payment of ES provider is in cash	1.994	1.193	0.095
Scheme compliance/enforcement				
	Dummy: 1 = ES providers are selected based on criteria	-2.487	1.167	0.033
	Dummy: 1 = Monitoring of quantified environmental objectives	1.403	0.819	0.086

N=47

R^2=0.47

Results

Variable	*Description*	*Coefficient estimate*	*Standard error*	*p*
Constant	-	3.807	2.089	0.068
General scheme characteristics				
	Dummy: 1 = PWS scheme is older than 10 years	1.472	0.972	0.130
	Dummy: 1 = PWS scheme is implemented at national level	-0.135	0.935	0.885
Players involved				
	Dummy: 1 = ES provider is private forest owner	0.964	0.912	0.290
	Dummy: 1 = ES users are downstream drinking water consumers	-0.155	0.979	0.874
	Dummy: 1 = ES users are downstream hydropower companies	4.513	2.347	0.054
	Number of intermediaries	-2.896	1.294	0.025
Nature of scheme participation				
	Dummy: 1 = Voluntary participation	-4.444	1.879	0.018
	Dummy: 1 = PWS contract is with whole community	2.858	1.476	0.053
Payment characteristics				
	Dummy: 1 = Payment of ES provider is in cash	1.994	1.193	0.095
Scheme compliance/enforcement				
	Dummy: 1 = ES providers are selected based on criteria	-2.487	1.167	0.033
	Dummy: 1 = Monitoring of quantified environmental objectives	1.403	0.819	0.086

N=47

R^2=0.47

Results

Variable	*Description*	*Coefficient estimate*	*Standard error*	*p*
Constant	-	3.807	2.089	0.068
General scheme characteristics				
	Dummy: 1 = PWS scheme is older than 10 years	1.472	0.972	0.130
	Dummy: 1 = PWS scheme is implemented at national level	-0.135	0.935	0.885
Players involved				
	Dummy: 1 = ES provider is private forest owner	0.964	0.912	0.290
	Dummy: 1 = ES users are downstream drinking water consumers	-0.155	0.979	0.874
	Dummy: 1 = ES users are downstream hydropower companies	4.513	2.347	0.054
	Number of intermediaries	-2.896	1.294	0.025
Nature of scheme participation				
	Dummy: 1 = Voluntary participation	-4.444	1.879	0.018
	Dummy: 1 = PWS contract is with whole community	2.858	1.476	0.053
Payment characteristics				
	Dummy: 1 = Payment of ES provider is in cash	1.994	1.193	0.095
Scheme compliance/enforcement				
	Dummy: 1 = ES providers are selected based on criteria	-2.487	1.167	0.033
	Dummy: 1 = Monitoring of quantified environmental objectives	1.403	0.819	0.086

N=47

R^2=0.47

Results

Variable	*Description*	*Coefficient estimate*	*Standard error*	*p*
Constant	-	3.807	2.089	0.068
General scheme characteristics				
	Dummy: 1 = PWS scheme is older than 10 years	1.472	0.972	0.130
	Dummy: 1 = PWS scheme is implemented at national level	-0.135	0.935	0.885
Players involved				
	Dummy: 1 = ES provider is private forest owner	0.964	0.912	0.290
	Dummy: 1 = ES users are downstream drinking water consumers	-0.155	0.979	0.874
	Dummy: 1 = ES users are downstream hydropower companies	4.513	2.347	0.054
	Number of intermediaries	-2.896	1.294	0.025
Nature of scheme participation				
	Dummy: 1 = Voluntary participation	-4.444	1.879	0.018
	Dummy: 1 = PWS contract is with whole community	2.858	1.476	0.053
Payment characteristics				
	Dummy: 1 = Payment of ES provider is in cash	1.994	1.193	0.095
Scheme compliance/enforcement				
	Dummy: 1 = ES providers are selected based on criteria	-2.487	1.167	0.033
	Dummy: 1 = Monitoring of quantified environmental objectives	1.403	0.819	0.086

N=47

R^2=0.47

Conclusions (1)

- Less than half of the schemes used quantifiable indicators and monitored conditionality (22 million ha land!)
- In majority of these cases the indicators referred to efforts put into scheme implementation, not impacts and outcomes
- Importance of user financed schemes (Wunder et al., 2008) confirmed in this study
- Role of national schemes in ES provision (Daniels et al., 2010) could not be confirmed
- Significant impacts scheme participation conditions on effectiveness ES provision:
  - Voluntary schemes significantly less likely to be successful
  - Community contracts have a positive effect

Conclusions (2)

- Wide variety of selection criteria used in PWS schemes, only one scheme used ES provision effectiveness as prime condition
- Multiple intermediaries are expected to increase transaction costs and hence undermine efficiency in ES provision
- Caveats:
  - Robustness analysis depends crucially on reliability input variables; simple binary dependent variable

  > results have to be interpreted with the necessary care!
  - Proper monitoring additionality conditions essential
  - International monitoring guidelines needed for comparisons between PES designs

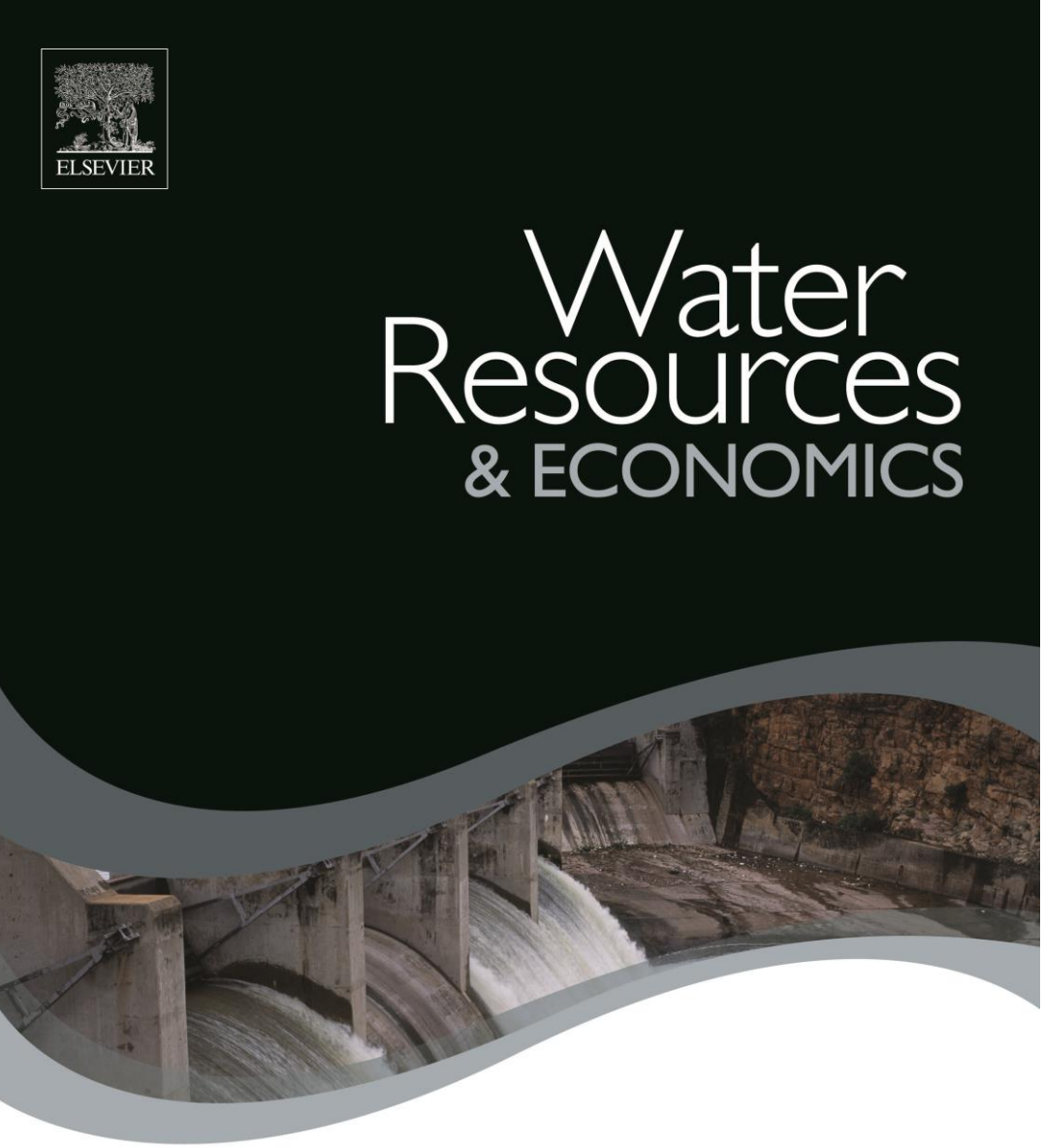
Thank you for your attention

rbrouwer@uwaterloo.ca

Brouwer, R., Tesfaye, A. & Pauw, P. (2011). Meta-analysis of institutional-economic factors explaining the environmental performance of payments for watershed services. Environmental Conservation, 38(4), 1-13. DOI:10.1017/S0376892911000543.

UNIVERSITY OF WATERLOO

the water INSTITUTE University of Waterloo



http://www.sciencedirect.com/science/journal/aip/22124284

IWA

UNIVERSITY OF WATERLOO

the water INSTITUTE University of Waterloo

The Role of Water Technology Innovation in the Blue Economy

4th Water Research Conference

In association with The International Water Association and The Water Institute – University of Waterloo

10 - 13 September 2017 | Crowne Plaza Kitchener-Waterloo

Abstract submission deadline: 10 March 2017. Submit abstract here »

Planet Earth faces increasingly imminent water resource scarcity challenges due to population growth, wealth accumulation, climate change and society's increasing demand for cleaner and more resource efficient production and consumption. Meeting growing demand and avoiding catastrophic global water resource scarcity require the development and implementation of water technology innovation on the one hand and behavioral changes on the other hand. These push/supply and pull/demand factors ideally go hand in hand, but typically lack in practice the necessary institutional-economic coordination and governance structures. In addition, evidence-based transformative strategies based on cost-effective and efficient economic policy instruments towards the Blue Economy are missing despite increasing policy and political interest in concepts such as circular economy.

This international water conference, co-chaired by the editors in chief of the Elsevier journals *Water Research* and *Water Resources and Economics* and endorsed by the International Water Association (IWA), aims to highlight, discuss and advance state-of-the-art thinking and research to support the transition towards a Blue Economy, in particular the role of water science and technology innovation and the necessary institutional-economic enabling environment to foster sustainable behavioral change in current water use and depletion.

The conference solicits disciplinary and interdisciplinary paper presentations on the relevant technological, economic, social and governance dimensions underlying technology adoption and behavioral change towards the Blue Economy, in particular in urban and rural water systems as depicted below.

Interrelated interdisciplinary components addressed at the international water conference

Register Now

Submit Abstract

View Program

Click to download apps

Poster in my Pocket app

Committee

Conference Chairs

Roy Brouwer, *The Water Institute – University of Waterloo, Canada*

Mark van Loosdrecht, *Delft University of Technology, The Netherlands*

Scientific Committee

Vic Adamowicz, *University of Alberta, Canada*

Ana Deletic, *Monash University, Australia*

Hiroaki Furumai, *University of Tokyo, Japan*

Arjen Hoekstra, *University of Twente, The Netherlands*

Peter Huck, *University of Waterloo, Canada*

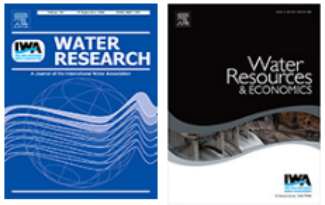
John Janmaat, *University of British Columbia, Canada*

Phoebe Koundouri, *Athens University of Economics and Business, Greece*

Tove Larsen, *Eawag, Switzerland*

Wun Jern Ng, *Nanyang Environment and Water Research Institute, Singapore*

Supporting Publications



Organised by

ELSEVIER

In association with

the water INSTITUTE

http://www.waterresearchconference.com/

UNIVERSITY OF WATERLOO

the water INSTITUTE University of Waterloo