



Exploring the scope for transboundary collaboration in the Blue Nile River Basin

Abonesh Tesfaye and Roy Brouwer

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Outline

- Problem
- Institutional design PWS
- WTP upstream for SCM
- WTP downstream for improved IWS
- Conclusions

Cause

- Severe erosion & land degradation in the highlands of Ethiopia ≈ 1.5 billion metric tons per year (e.g. Sonneveld, 2002)
- Unsustainable land use management, loss of productive land

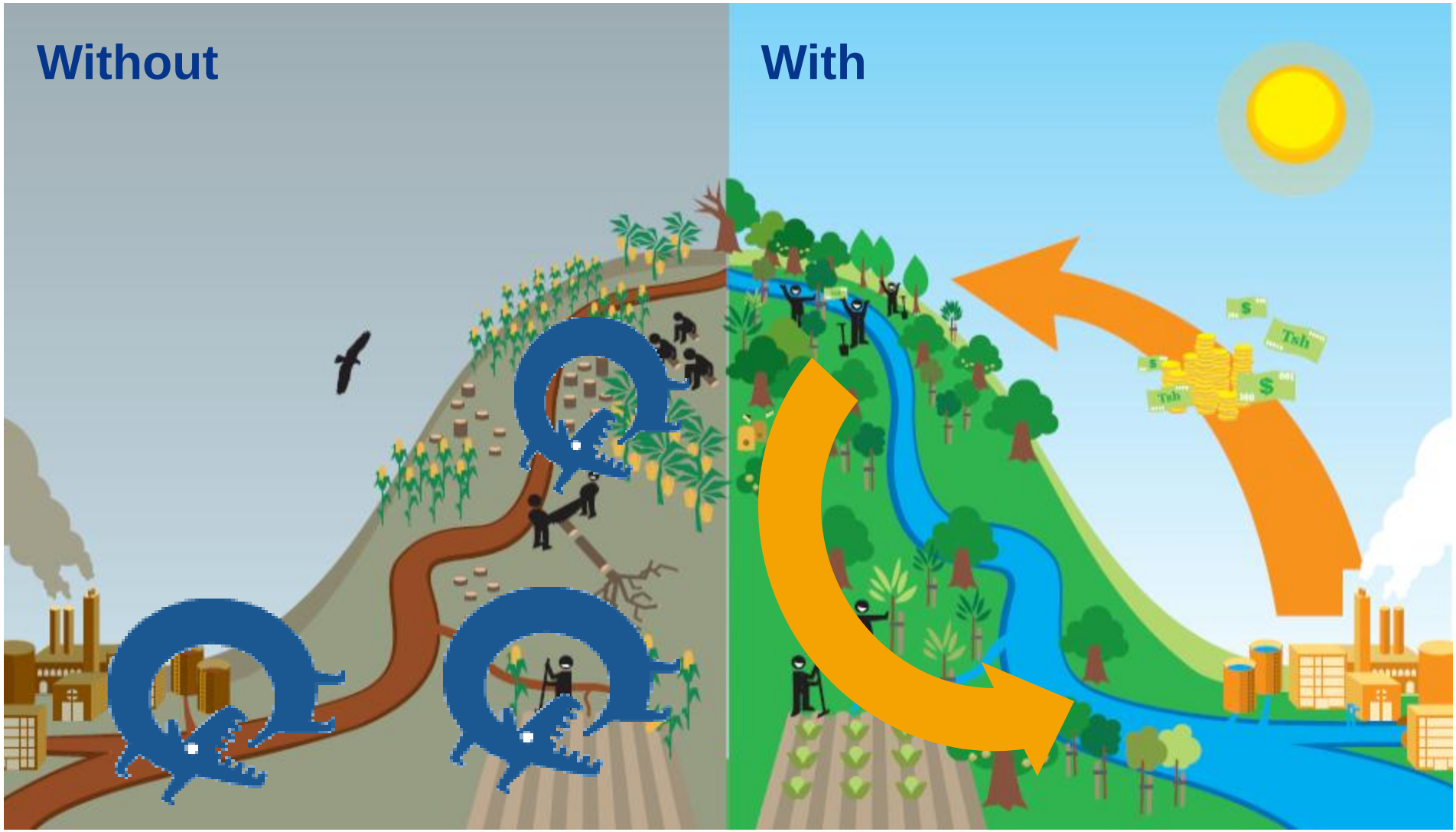
Effect

- Erosion results in major sedimentation and siltation of water courses downstream, in particular the Gezira irrigation scheme
- Sediment deposition blocks water inlet pipes and gates, reduces irrigation canal flow capacity, cropped area and yield
- Siltation of the canal systems is getting worse every year and the costs of keeping the irrigation canals open increases
- Over the past 10 years 16.5 Mm^3 of sediment was removed at a cost of more than US$ 12 million (Gismalla, 2009)

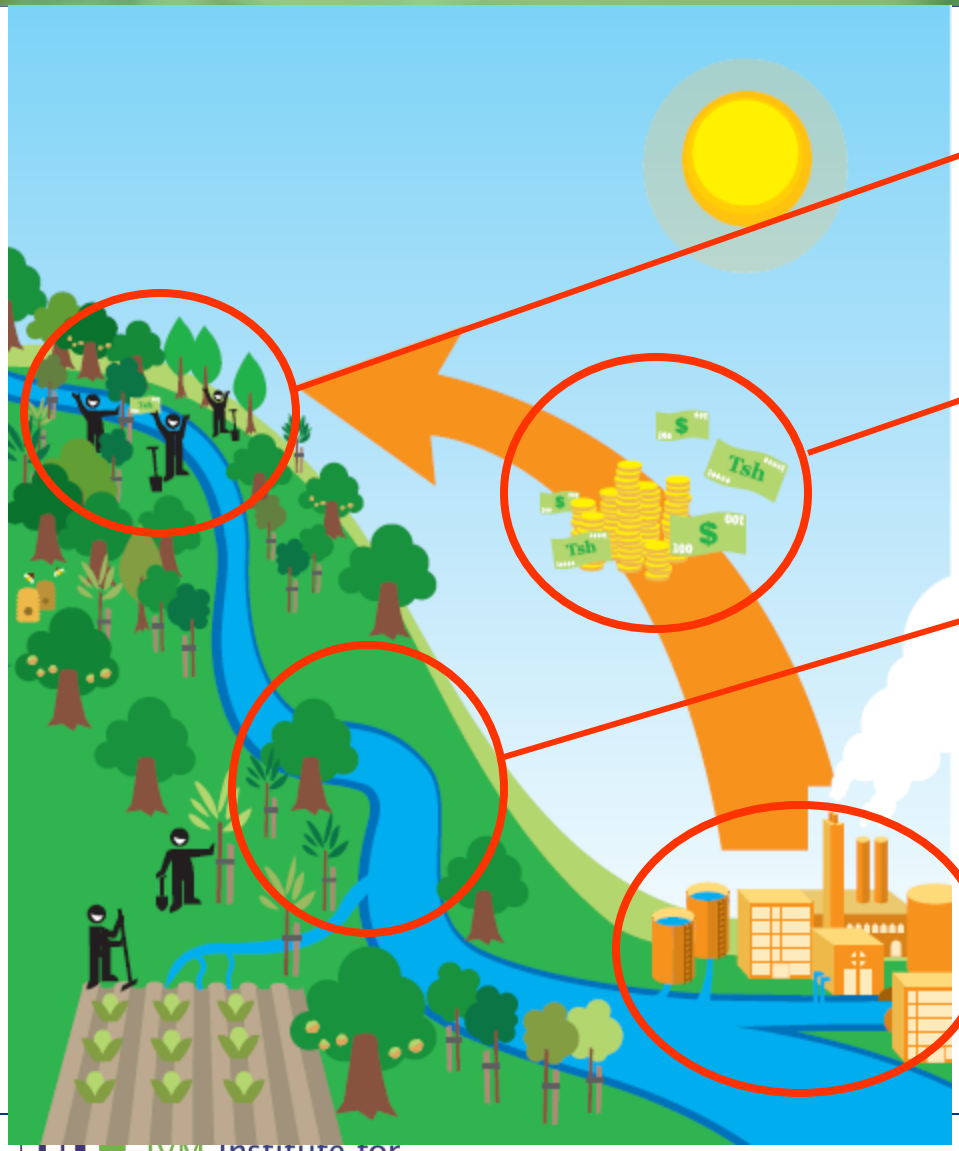
Scope for transboundary cooperation

- Sustainable agricultural practices upstream, including soil conservation, are needed to protect downstream areas against sedimentation (Merrey and Gebreselassie, 2011)
- Theoretically: WTP for improved irrigation water supply and WTA compensation for soil conservation measures
- Hence, beneficiaries downstream compensate the water service providers upstream
- Actual price paid somewhere between maximum WTP and minimum WTAC

Payments for watershed services



What a decision maker needs to know is …



WTA of upstream residents

Institutions & financial mechanism

Hydrological & carbon assessment

WTP of downstream beneficiaries

Empirical evidence

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

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Meta-analysis of institutional-economic factors explaining the environmental performance of payments for watershed services

ROY BROUWER[1]*, ABONESH TESFAYE[1] AND PIETER PAUW[2]
[1]*Department of Environmental Economics, Institute for Environmental Studies, VU University Amsterdam, De Boelelaan 1087, 1081 HV, Amsterdam, the Netherlands, and* [2]*Department of Spatial Analysis and Decision Support, Institute for Environmental Studies, VU University Amsterdam, De Boelelaan 1087, 1081 HV, Amsterdam, the Netherlands*
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THEMATIC SECTION
Payments for Ecosystem Services in Conservation: Performance and Prospects

SUMMARY

Payments for ecosystem services (PES) are a relatively new economic policy instrument, and the factors that drive and explain their environmental performance are poorly understood. Here a meta-analysis of causal relationships between the institutional design and environmental performance of 47 payments for watershed services (PWS) schemes worldwide showed a significant effect on environmental achievement of the terms and conditions of scheme participation, including the selection of service providers, community participation, the existence and monitoring of quantifiable objectives, and the number of intermediaries between service providers and buyers. Direct payments by downstream hydropower companies to upstream land owners for reduced sediment loads were identified as a successful PWS example. No other significant explanatory factors, such as specific type of watershed service, age or scale of implementation of the PWS scheme were detected. The results are highly dependent on the reliability of the input variables, in particular the measurement of the environmental performance variable. Despite efforts to find quantitative information on the environmental performance of existing PWS schemes, such empirical evidence is lacking in many of the schemes studied. International monitoring guidelines are needed to facilitate comparisons, identify success factors and support the future design of cost-effective PWS schemes.

Keywords: environmental performance, institutional-economic conditions, meta-analysis, payments for ecosystem services, watershed markets

INTRODUCTION

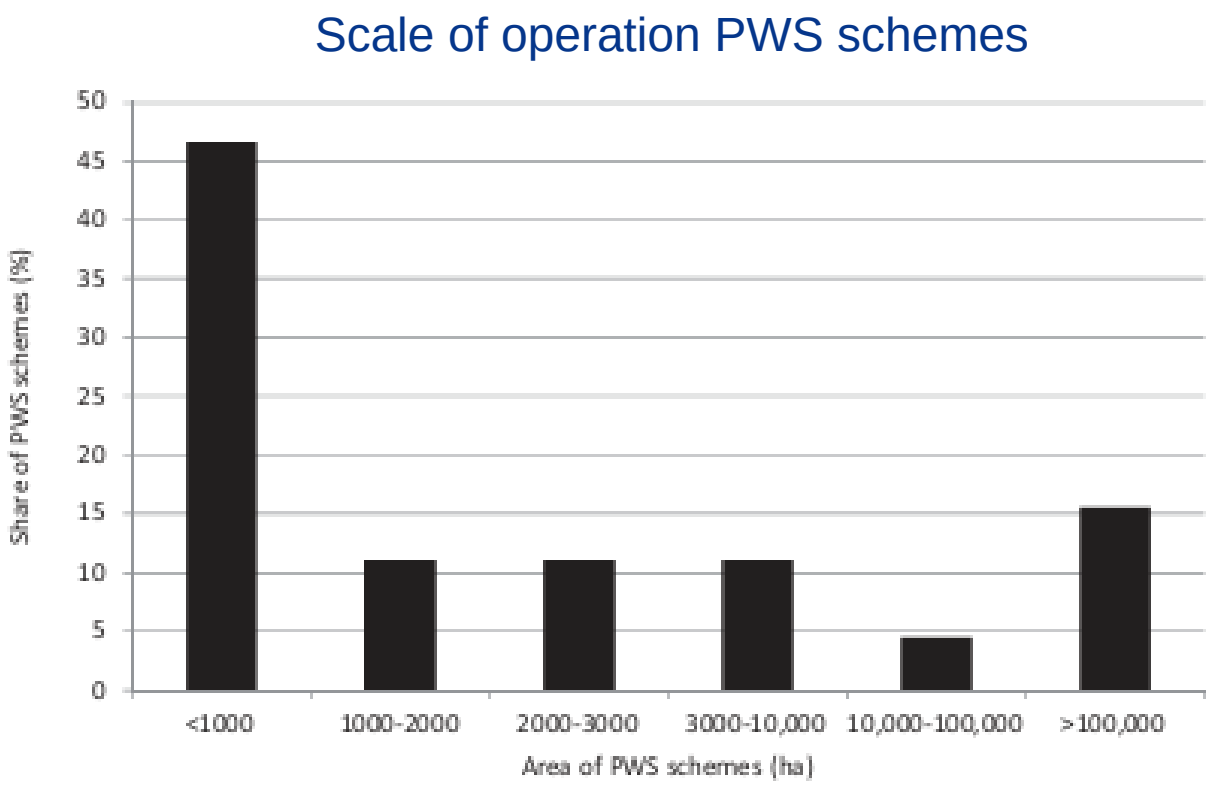
Payments for ecosystem services (PES) are a relatively new economic policy instrument, which aim to translate the often non-market value of environmental goods and services into financial incentives to preserve the ecosystems that provide these services (Salzman 2005; Wunscher *et al.* 2008). The basic principle behind PES is that resource owners and communities who are in a position to provide ecosystem services should be compensated for the cost of their provision, and that those who benefit from these services should pay for them, thereby internalizing the benefits (Mayrand & Paquin 2004). Wunder (2005) outlined five criteria to describe PES: a voluntary transaction, where well-defined ecosystem services (ES) are bought by a ES user from a ES provider under the agreed ES quantity and quality conditions in the transaction (conditionality requirement). In practice, PES is used as a more generic term for a variety of arrangements where local communities, farmers and other water and land managers are paid for conservation activities that deliver ES, of which biodiversity and landscape preservation, carbon sequestration and water protection are most common (Duncan 2006). PES has many attractive characteristics relative to other conservation approaches. However, ascertaining their advantages requires measuring the additional effects of actual programmes in the field, also referred to as the additionality requirement (Daniels *et al.* 2010). Such impact evaluation can also help in identifying opportunities for further improvements in efficiency of these programmes (Kerr & Jindal 2007).

Existing reviews of PES schemes and assessments of success and fail factors are mainly qualitative in nature. This includes, among others, special issues in the journals *Ecological Economics* (Engel *et al.* 2008; Farley & Costanza 2010), *Environment and Development Economics* (Bulte *et al.* 2008), and the *Journal of Sustainable Forestry* (Rebelo 2009). Bulte *et al.* (2008) focused on PES both as a mechanism for environmental protection and poverty reduction, and showed that tying PES and poverty reduction may result in lower efficiency in meeting either objective, thus it may be better to focus programmes that concentrate on one or the other objective separately. Wunder *et al.* (2008) conducted a comparative analysis of PES in developed and developing countries between user financed and government financed schemes using different criteria, including design, costs, environmental effectiveness and livelihood outcomes.

*Correspondence: Dr Roy Brouwer Tel: +31 20 598 5608 Fax: +31 20 598 9553 e-mail: roy.brouwer@ivm.vu.nl

Scheme characteristics

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



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 primary 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

Transboundary research design

- Choice experiment to assess willingness of upstream farmers in Ethiopian highlands to invest in soil conservation (n=750)

- Choice experiment to assess willingness to pay higher water fees of downstream farmers in Gezira, Sudan to obtain improved irrigation water supply (n=200)

Upstream survey

- Past top-down Gvt and NGO interventions ineffective largely due to lack of proper incentives (e.g. Shiferaw and Holden, 1999; Bekele, 2004; Holden et al., 2009)
- Contribute to the development of incentive-compatible contract design based on identification of institutional-economic conditions needed to be in place for farmers to invest in SCM
- Estimate FHH demand for contractual agreements under different soil erosion and institutional-economic terms and conditions
- Test farmer choice behavior under different cost (of measures) and price (of contracts) settings - '*menu of contracts*' (Ferraro, 2008)

Contract (1)

- Incentive found in private gains for FHH if they invest in SCM (and sustaining water services in Blue Nile river basin)
- Trade-off: invest in land conservation and sustain yield and income in long term versus not investing in SCM which will reduce yields further and increasing income losses
- Contract aims to facilitate and support this private investment decision

Contract (2)

- Principal (Govt) offers contracts on voluntary basis to wide variety of agents (farmers) and provides necessary financial means to invest in SCM in return for right to ascertain certain LUM conditions and secure rights over public benefits (water services)
- Private value (sustainable income from yield) falls upon farmers entering the contract
- Most important source of uncertainty in investment decision is removed through the allocation of land use certificates
- Payment mechanism is credit provided by principal, provision costs of which are borne by farmers and paid from increase in income due to SCM

Contract (3)

- Significant deviation from existing PES literature where farmers are typically compensated for environmental services provided (avoid risk of free riding)

- Participation constraints are tested for poorer farmers who

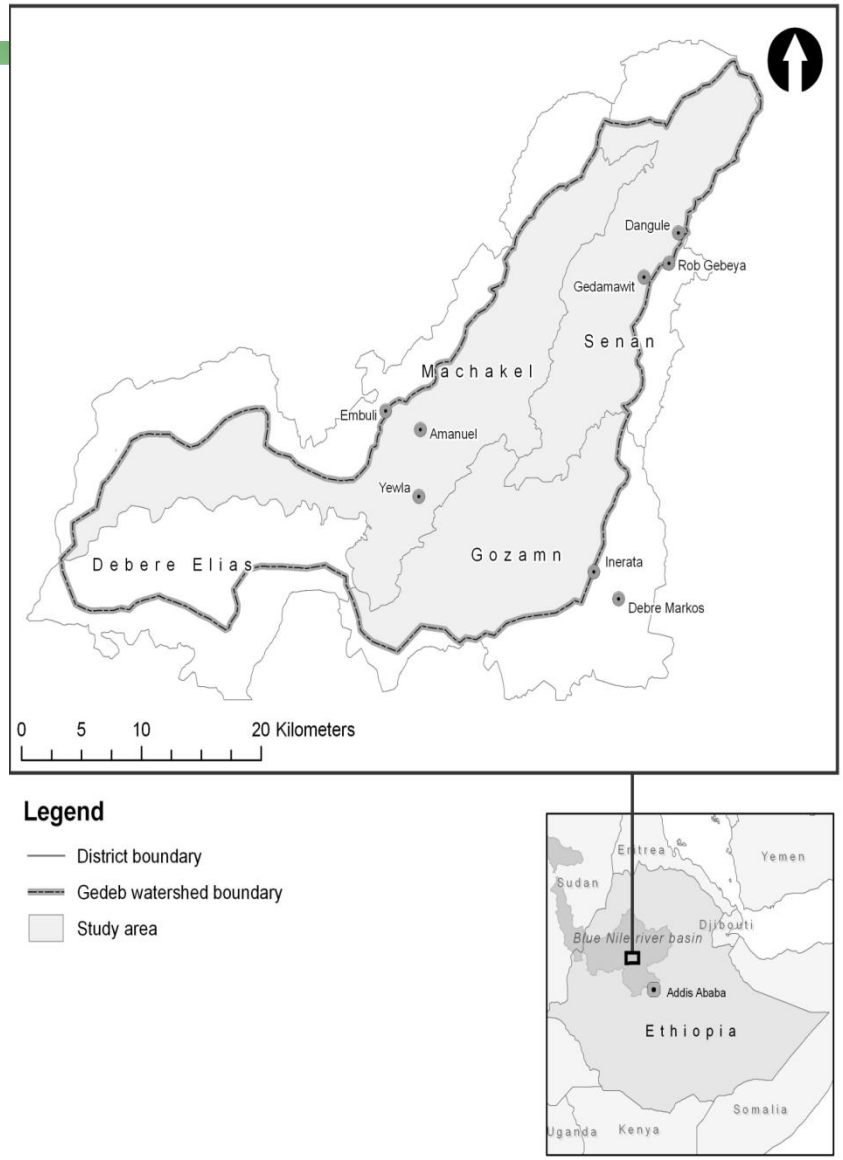
  -live in the most erosion sensitive areas

  -take no soil conservation measures

  -have no or limited access to credit facilities

Sampling

- Study site = Gedeb watershed
- Elevation 1,500 – 4,000 masl
- Area size: 871 km^2
- Population: 495 thousand



Choice experiment

Main characteristic	Detailed levels in contract
Principal (contract provider)	Regional Agricultural Bureau
	Local Peasant Association
Contract length	1-2-3-5-10 years
Monthly payment	50-100-150-200-250-300 Birr
Land use certificate guarantee	Yes, No
Soil conservation measure	Stone bund
	Soil bund
	Fanya juu
Additional extension service	1-2-4-6 times per year

	Contract 1	Contract 2	None of the two
Contract provider	 Regional Board	 Peasant Association	No contract
Contract length	 5 years	 1 year	Not applicable
Land use certificate	 Yes	 Yes	No certificate guarantee
Soil conservation measure	 Stone bund	 Fanya juu	No extra measures
Extension Service	 6 times/year	 2 times/year	No extra service
Monthly payment	 300 Birr	 100 Birr	0 Birr

Results (1)

- Positive demand for contractual agreements: < 10% not willing to conclude a contract
- Contracts
  - provided by local PA
  - offering additional credit, land use security, extension services

  can be an effective means to increase the share of farmers implementing SCM
- Despite the fact that most farmers already have a land use certificate, this attribute is valued highly by all farmers

Results (2)

- Important reasons:
  - Farmer experiences with a long history of land redistribution
  - Lack of trust that certificates will guarantee future use rights
- Contracts appeal most to target group most in need of taking action:
  - Farmers who already take measures less likely to participate
  - Poorer farmers with no access to credit, facing higher soil erosion rates are more likely to participate
  - Rational behavior: participation if contract price is lower than income loss from soil erosion

Downstream survey

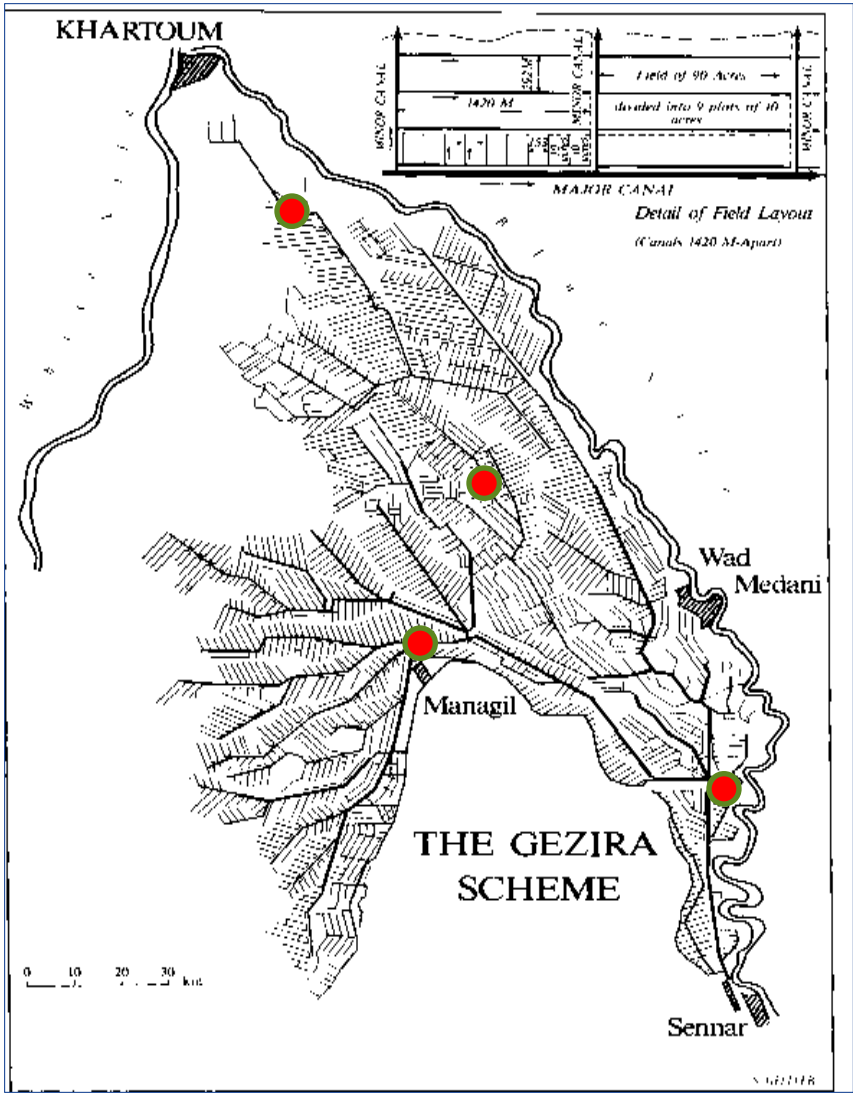
- First valuation study of irrigation water supply in an international, transboundary setting
- Only recently has economic valuation of irrigation water been placed in a broader institutional-economic context of water rights and irrigation water governance (e.g. Speelman et al., 2010; Veettil et al., 2011)
- Estimation of farmers' demand for improved irrigation water supply focusing on two possible solutions:
  - *A local one* where irrigation water supply is guaranteed through enhanced management of irrigation water channels in Gezira
  - *An international one* where irrigation water supply is guaranteed through transboundary cooperation between the governments of Sudan and Ethiopia, who share the same river: the Blue Nile

Research question

- To what extent are Sudanese farmers downstream willing to pay for sustainable soil conservation measures upstream in Ethiopia as an alternative to paying for the sediment dredging costs through their irrigation fee?

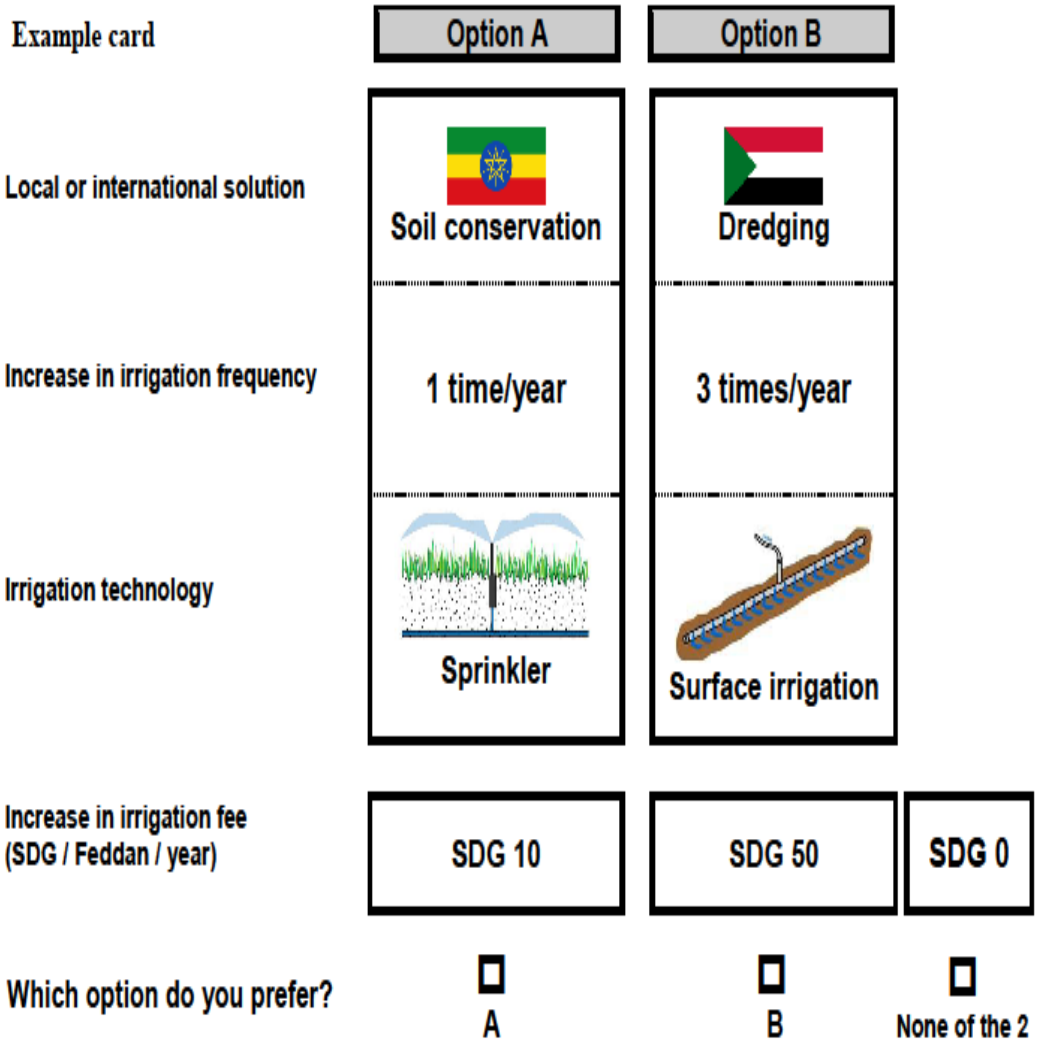
Sampling

- Study area: Gezira
- Largest irrigation scheme in the world
- Area size: 882 thousand hectares
- Gravity irrigation
- Population: > 100 thousand tenants
- 2300 km main irrigation channels
- 8000 km minor channels
- Mean rainfall 200-400 mm/year
- Temperatures: 5^0 C - 46^0 C



Choice experiment

Main characteristics	Levels
Local or international solution	Dredging Soil conservation
Increase in irrigation frequency	1time more 2 times more 3 times more 4 times more
Irrigation technology	Surface irrigation Sprinkler
Increase in irrigation fee	10 SDG 20SDG 30SDG 50SDG



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Survey implementation

- 200 farmers in the Gezira scheme interviewed in April 2012
- Farmer sampling following a randomized block design
- The Gezira scheme was divided in 4 parts:

  - head, tail, middle part and extension (Managil)

- In each of these parts, 2 villages were randomly sampled and within each village 25 farmers were interviewed

Results: Problem perception

- Water shortage perception and Blue Nile hydro-solidarity
- Water shortage identified as most important farming proble
- More upstream farmers and farmers living in the middle part of the scheme mentioned sedimentation as the most important reason for water shortages (65% and 60% respectively)
- Sedimentation is considered a big problem by a majority of all farmers upstream, downstream and in the middle part of the irrigation scheme (varying between 57% and 73%)
- One third blame farmers upstream in Ethiopia for sedimentation while just over half (53%) blamed the current management of the irrigation scheme

Results: Hydrosolidarity

- Farmers do not consider themselves responsible for the sedimentation problems
- Farmers feel very connected to each other, especially in terms of sharing irrigation water during times of shortage
- When asked about their sense of transboundary solidarity, i.e. how connected they feel to farmers upstream in Ethiopia, a majority of 64 % report not to feel any connection
- Almost all farmers (97%) would be in favor of increased transboundary cooperation in the Blue Nile Basin to secure future water supply

Results: Choice experiment

- Farmers value transboundary cooperation to reduce siltation of the irrigation canals significantly higher than improving local irrigation water canal management
- As expected, increase in irrigation frequency valued positively
- Sprinkler irrigation preferred over current flood irrigation
- Negative disposition towards higher irrigation water fees
- Significant positive alternative specific constant (ASC) implying that farmers prefer some change to no change from the current situation

Results: Differences between farmers

- Farmers value an increase in irrigation water availability less if they already have more frequent access to irrigation water (measured by the interaction between the attribute *increase in irrigation frequency* and *current baseline irrigation frequency*)
- Farmers living in the western extension of the Gezira scheme value an increase in irrigation frequency less than farmers living at the head of the scheme
- Farmers who use water more efficiently value an increase in irrigation water supply higher than farmers who use water less efficiently

Results: Differences between farmers

- No significant anchoring of choices on current price levels farmers pay for the cash crops they grow in the area
- Current prices do not seem to be in any way related to water use efficiency, scarcity costs or cost recovery of the operation and maintenance costs of the irrigation canals
- Water use efficiency no impact on interest in new irrigation technology
- Education, age or farming experience levels also did not have any effect on the choices farmers made during the choice experiment

Willingness to pay

- Farmers are willing to pay on average US$ 1.6 per hectare for every extra time they are allowed to flood their land
- Farmers are WTP less than one dollar per hectare to change from flood to more efficient sprinkler irrigation
- Farmers are WTP US$ 1.2 per hectare more for transboundary cooperation than improving local irrigation water governance
- Compared to the average price farmers pay for irrigating the main cash crops in the area (groundnuts, cotton, wheat, sorghum) this implies an extra charge of no more than 4% for one extra time of flood irrigation

Conclusions

- Transboundary RBM and provision of water services typically defined in economic terms of downstream WTP and upstream WTA
- Direct user schemes appear most effective in water service delivery, increasing numbers of intermediaries increase transaction costs, need for international monitoring guidelines
- Important to first investigate (1) private incentives for sustainable land use management instead of immediately offering compensation (2) applicability of guiding principles such as PPP and BPP
- In this study we find scope for transboundary cooperation, important question remains of course how to organize this >> political decision-making process

Thank you for your attention

r.brouwer@vu.nl