A social-ecological approach to collective action for water quality management in agriculture. The case of drinking water source protection in France.

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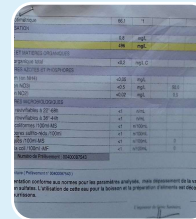TED4LAT workshop and doctoral school
October 23rd, 2024

Introduction

- Diffuse pollution from agriculture (nitrates, pesticides)

  - A significant pressure on surface and ground waters in the European Union and French contexts

  - Multiple environmental, economic and social impacts

Impact on ecosystems and biodiversity

- Eutrophication

Human health risk

- Regulatory standards for nitrate and pesticide rates (EU Drinking Water Directive)

Extra-costs of drinking water production

- Water treatments, resource blending/substitution

Introduction

- EU Water Framework Directive (WFD) (2000)

  - Objective of good status for all water bodies in Europe

  - Protection of water bodies used for drinking water production "*in order to reduce the level of purification treatment required*"

- "Grenelle" policy in France (2009)

  - Identification of 1000 priority water catchments

  - Definition and implementation of action programs targeting diffuse pollution

    - Cooperation between water suppliers and agricultural stakeholders (farm organizations, farmers)

Introduction

- "Grenelle" policy in France (2009)

  - Mixed outcomes

    - Only half priority catchments covered by an action program in 2019 (MTE, 2020)

    - No significant improvement in water quality

- Research objective :

  ➢ Identifying the factors affecting the success/failure of collective action

Outline

1. Conceptual framework

- A combination of the Social-Ecological Systems (SES) framework and transaction cost economics

2. Methodology

- A comparative multi-case study approach

3. Results

- The factors favoring/constraining collective action

4. Conclusion

Conceptual framework

- Transaction cost economics

  - The development of cooperation depends on the benefits and costs linked to participation to collective action
  - Transaction costs = resources used to define, establish, maintain and transfer property rights (Allen, 2000)

- In the field of natural resource management and environmental policy (McCann et al., 2005)

  - *Ex-ante* transaction costs : information collection and processing costs, decision-making costs and/or negotiation costs for reaching agreements
  - *Ex-post* transaction costs : monitoring and enforcement costs of agreements

Conceptual framework

Benefits and costs of collective action

Benefits

Costs

Transaction costs

Costs for defining actions (ex ante)

Costs for implementing actions (ex post)

Drinking water suppliers

Water quality improvement/maintenance

Opportunity costs of alternative options

Economic resources

Information costs

Consultation/negotiation costs

Control/enforcement costs

Farmers

Savings from input reduction

Subsidies/compensation

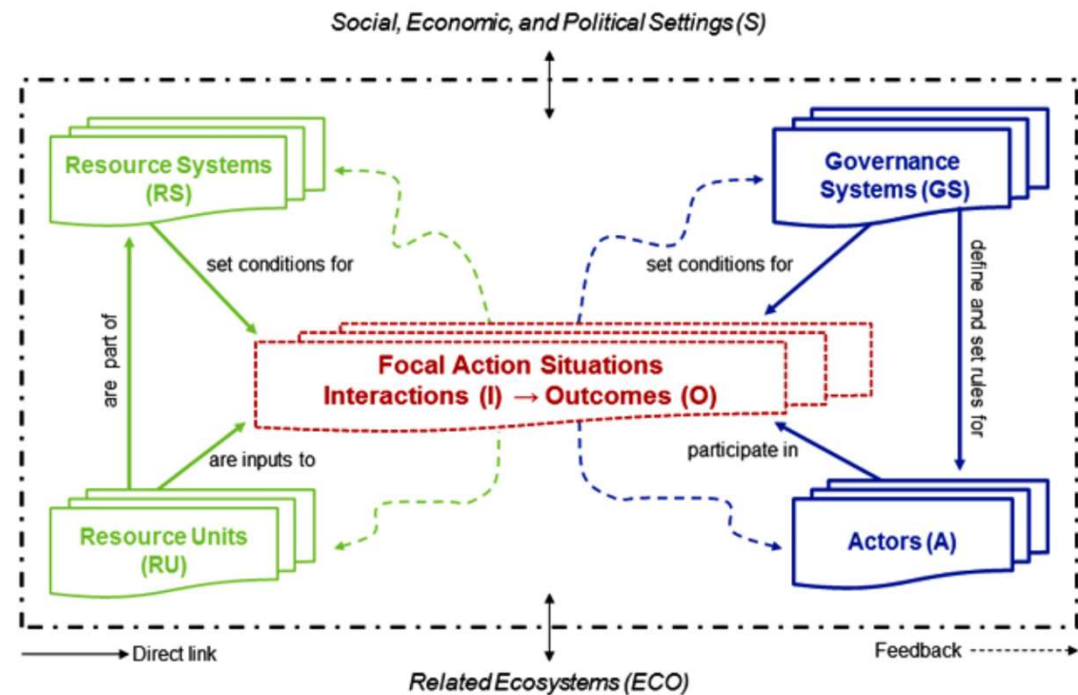Profit losses

Labor/investment costs

Information costs

Consultation/negotiation costs

Control costs

Sanctions (non-compliance)

Conceptual framework

- **Social-Ecological Systems (SES) framework**
  - Identification of the factors affecting the benefits and costs of collective action

Ostrom, 2007; McGinnis and Ostrom, 2014

Conceptual framework

- SES framework : focal action situations

  - Actors make choices among available options in light of information about the likely actions of other participants and the benefits and costs of options

- Interactions : harvesting, information sharing, self-organizing activities, conflicts…

- Outcomes :

  - Social performance measures (efficiency, equity…)

  - Ecological performance measures (biodiversity, resilience,…)

Conceptual framework

- SES framework : governance systems

  - Multi-level sets of rules

Constitutional rules

Individuals' actions taken that affect collective-choice situations
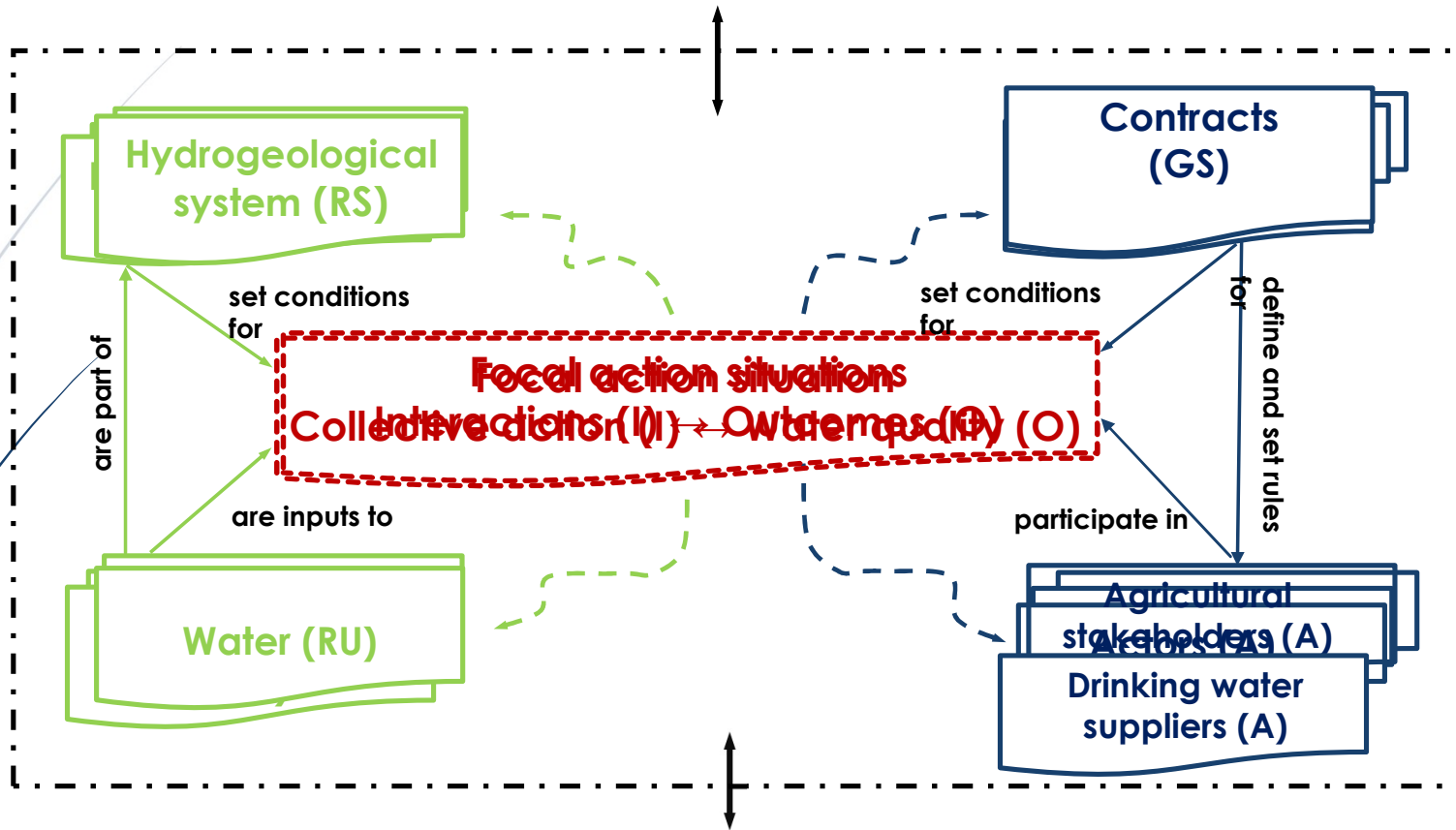**Constitutional situations**

Collective-choice rules

Individuals' actions taken that affect operational situations
Collective-choice situations

Operational rules

Individuals' actions taken that affect the resource
Operational situations

Related Social, Economic, and Political Settings (S)

Hydrogeological system (RS)

Contracts (GS)

set conditions for

set conditions for

define and set rules for

are part of

Focal action situations

Collective action (I) → Water use (I) (O)

Interactions (I) → Outcomes (O)

are inputs to

participate in

Water (RU)

Agricultural stakeholders (A)
actors (A)

Drinking water suppliers (A)

Related Ecosystems (ECO)

First-tier variable	Second-tier variables
Social, economic, and political settings (S)	S1 – Economic development S2 – Demographic trends S3 – Political stability S4 – Other governance systems S5 – Markets S6 – Media organizations S7 – Technology
Resource systems (RS)	RS1 – Sector (e.g., water, forests, pasture, fish) RS2 – Clarity of system boundaries RS3 – Size of resource system RS4 – Human-constructed facilities RS5 – Productivity of system RS6 – Equilibrium properties RS7 – Predictability of system dynamics RS8 – Storage characteristics RS9 – Location
Governance systems (GS)	GS1 – Government organizations GS2 – Nongovernment organizations GS3 – Network structure GS4 – Property-rights systems GS5 – Operational-choice rules GS6 – Collective-choice rules GS7 – Constitutional-choice rules GS8 – Monitoring and sanctioning rules
Resource units (RU)	RU1 – Resource unit mobility RU2 – Growth or replacement rate RU3 – Interaction among resource units RU4 – Economic value RU5 – Number of units RU6 – Distinctive characteristics RU7 – Spatial and temporal distribution
Actors (A)	A1 – Number of relevant actors A2 – Socioeconomic attributes A3 – History or past experiences A4 – Location A5 – Leadership/entrepreneurship A6 – Norms (trust-reciprocity)/social capital A7 – Knowledge of SES/mental models A8 – Importance of resource (dependence) A9 – Technologies available
Related ecosystems (ECO)	ECO1 – Climate patterns ECO2 – Pollution patterns ECO3 – Flows into and out of focal SES

McGinnis and Ostrom, 2014

Conceptual framework

- A sub-set of factors likely to be critical for the success of self-organized collective action involving users of a common-pool resource (Ostrom, 2009)

First-tier variable	Second-tier variables
Resource system (RS)	RS3 – Size of resource system RS5 – Productivity of system RS7 – Predictability of system dynamics
Resource unit (RU)	RU1 – Resource mobility
Governance system (GS)	GS6 – Collective-choice rules
Actors (A)	A1 – Number of relevant actors A5 – Leadership A6 – Norms (trust-reciprocity)/social capital A7 – Knowledge of SES A8 – Importance of resource (dependence)

➢ Set of assumptions regarding factors affecting collective action for diffuse pollution control

Conceptual framework

First-tier variable	Second-tier variable	Impact on benefits/costs and Transaction Costs (TCs)	Impact on collective action
Resource system (RS)	RS3 – Size of resource system	↗ TCs Small size ↘ benefits	-/+
	RS5 – Productivity of system	Moderate scarcity ↗ benefits	+
	RS7 – Predictability of system dynamics	↘ TCs	+
Governance system (GS)	GS6 – Collective-choice rules	Autonomy of users ↘ TCs	+
Resource units (RU)	RU1 – Resource unit mobility	Mobile units ↗ TCs	-
Actors (A)	A1 – Number of relevant actors	↗ TCs Small number ↘ resources	-/+
	A5 – Leadership-entrepreneuship	Presence of leaders ↘ TCs	+
	A6 – Norms/social capital	Shared norms/trust ↘ TCs	+
	A7 – Knowledge of SES	↘ TCs	+
	A8 – Importance of the resource	↗ benefits	+

Adapted from Ostrom, 2009

Methodology

1. **A review of cases of cooperation in the French context**

   - Literature review

   - Interviews with stakeholders at the water basin and national levels (12)

     - Ministries, water agencies, farm organizations, private water operators

2. **Case studies of collective action in six drinking water catchments**

   - Review of documents

   - Interviews with local stakeholders involved in cooperation (36)

     - Water suppliers, farm organizations, state administrations, farmers

Methodology

Val-de-Reuil catchment (Eure)

Ammertzwiller catchment (Haut-Rhin)

Arcier catchment (Doubs)

Allier catchments (Allier)

Virieu catchments (Isère)

Oursbelille catchment (Hautes-Pyrénées)

Artois-Picardie
Rhin-Meuse
Seine-Normandie
Loire-Bretagne
Adour-Garonne
Rhône-Méditerranée-Corse

LILLE
AMIENS
ROUEN
PARIS
CHALONS-EN-CHAMPAGNE
METZ
RENNES
ORLEANS
DIJON
NANTES
LIMOGES
CLERMONT-FERRAND
LYON
BORDEAUX
MONTPELLIER
MARSEILLE
TOULOUSE

FRANCE

● Case of collective action   — River basins
▲ CITY

Sources: Sandre, IGN GeoFLA
Realization: G. Brétière - March 2019

0 50 100   200
Kilometers

Methodology

	Allier	Virieu	Oursbellile	Arcier	Ammertzviller	Val de Reuil
Regulatory frame	Grenelle	Grenelle	Grenelle	Grenelle	SDAGE Rhin-Meuse	-
Start date	2009	2009	2009	2004	2008	2008
Type of pollution	Nitrates	Pesticides	Nitrates	Pesticides	Nitrates/pesticides	-
Level of contamination	Moderate	High	High	Moderate	High	Good water quality
Catchment area	8300 ha	115 ha	396 ha	10 200 ha	363 ha	127 ha
Number of farms	118	10	19	72	30	7
Farming systems	Mixed farming	Livestock	Field crops	Mixed farming	Field crops	Field crops
Outcomes						
Farm participation	3/118	5/10	7/19	20/72	16/30	4/7
Area covered	0,9 %	40 %	18 %	19,5 %	22 %	87 %
Water quality trend	No improvement	Improving trend	No improvement	Improving trend	Improvement	Maintenance of good quality

The factors affecting collective action

- The factors affecting the benefits of water suppliers

Factors	Impact on collective action
Level of water contamination	+
Cost of alternative approaches to water catchment protection	+
Financial and human resources	+
External support from public agencies	+

The factors affecting collective action

- The factors affecting the benefits of farmers

Factors	Impact on collective action
Type of farming systems	Intensive: - Extensive: +
Markets/food supply chains	-/+
Economic incentives provided by contracts	-/+
Environmental preferences	+

The factors affecting collective action

- The factors influencing transaction costs

Factors	Impact on transaction costs	Impact on collective action
Size of the water catchment	Negotiation, control and enforcement costs	-
Predictability of hydrogeological system dynamics	Information costs	+
Knowledge	Information costs	+

The factors affecting collective action
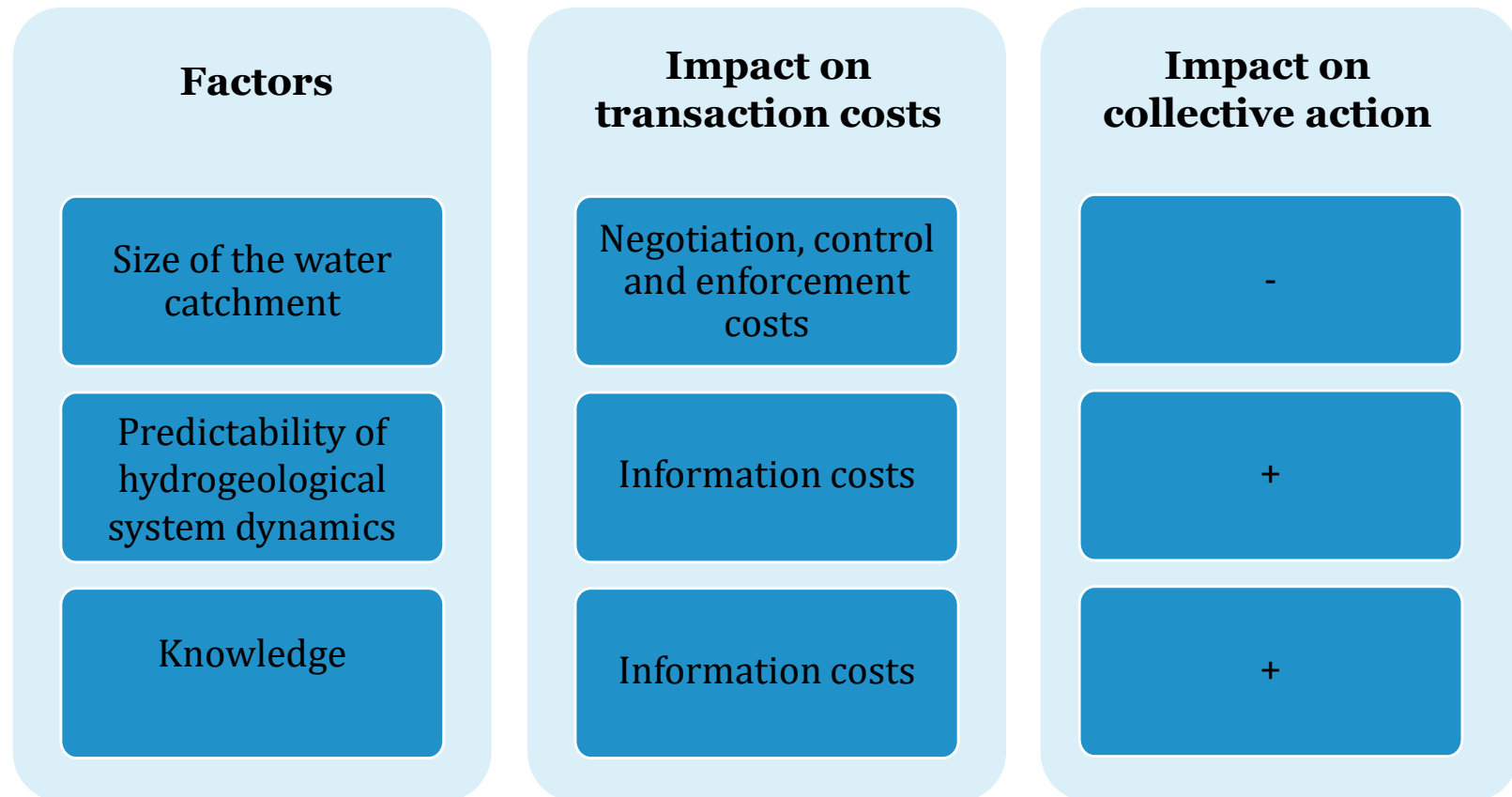
The factors influencing transaction costs

Factors	Impact on transaction costs	Impact on collective action
Involvement of farming leaders	Negotiation, control and enforcement costs	+
Norms of reciprocity/social capital	Negotiation, control and enforcement costs	+
Autonomy in contract design	Trade-off benefits/transaction costs	-/+

Conclusion

- The factors favoring/constraining cooperation between water suppliers and farmers

  - Interactions between the characteristics of the resource system, the actors involved, the governance system and the broader context

  - The sub-set of 2nd tier variables identified as crucial for the success of collective action by users of a common-pool resource >

    - Resource mobility (groundwater versus surface waters)

Conclusion

- The factors favoring/constraining cooperation between water suppliers and farmers

    - Other SES variables as conditions for the success of collective action

        - Socio-economic attributes of water suppliers and farmers >

        - The economic and policy context >

First-tier variable	Second, third and fourth-tier variables
Social, economic and political settings (S)	**S4 – Other governance systems**
	S4.1 – Larger scale governance systems
	S4.1.1 – External support from public agencies
	S5 – Markets
	S5.1 – Market conditions for agricultural products
Resource systems (S)	**RS3 – Size of resource system ***
	RS3.1 – Size of the water catchment
	RS5 – Productivity of system *
	RS5.1 – Level of water contamination
	RS7 – Predictability of system dynamics *
Governance systems (GS)	GS5 – Operational rules
	GS5.1 – Contract incentives
	GS6 – Collective-choice rules*
	GS6.1 – Autonomy at the collective-choice level
	GS8 – Monitoring and sanctioning rules
	GS8.1 – Contract enforcement
Actors (A)	**A1 – Number of relevant actors ***
	A1.1 – Number of farmers
	A2 – Socio-economic attributes
	A2.1 – Resources available to water suppliers
	A2.2 – Type of farming systems
	A2.3 – Heterogeneity of farming systems
	A5 – Leadership-entrepreneurship *
	A5.1. – Leadership in the farming community
	A6 – Norms (trust-reciprocity)/social capital *
	A7 – Knowledge of SES *
	A8 – Importance of the resource *
	A8.1 – Economic importance for water suppliers
	A8.2 – Environmental preferences of water suppliers/farmers

Conclusion

- Results = adaptation of the SES framework to the case of collective action for drinking water source protection

  - Use of identified factors as assumptions to be tested on a larger sample of cases in France

  - Application of the adapted framework to cases of cooperation in other countries

    - The role of factors linked to the different institutional context at the national/EU levels

Thanks for your attention

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