6-2019

Empirically-Informed Agent Based Modeling of Incentivized Forest Conservation - June 2019

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Citation Details

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EfD Forest Collaborative Meeting

26th June, 2019

Manchester

Overview

Background

Payment for ecosystem services (PES):

- popular and 'easy', BUT
- complex to design
    - do they work?
    - how (why) do they (not) work?
    - crowding out effect?
    - heterogenous effect?
- context dependent

Background...

Framed field experiment (FFE):

- Nine villages in Ethiopia
- Sample of 432 household heads
- Formed groups of 8 randomly
- Each group endowed with 60 tree branches ('forest stock')

The experiment: baseline

Payoff

$$\pi_{it} = x_{it} + 2 \left(\frac{60 - \sum x_{it}}{8} \right), \text{where} \quad x_{it} \leq 5$$

- Individuals face social dilemma
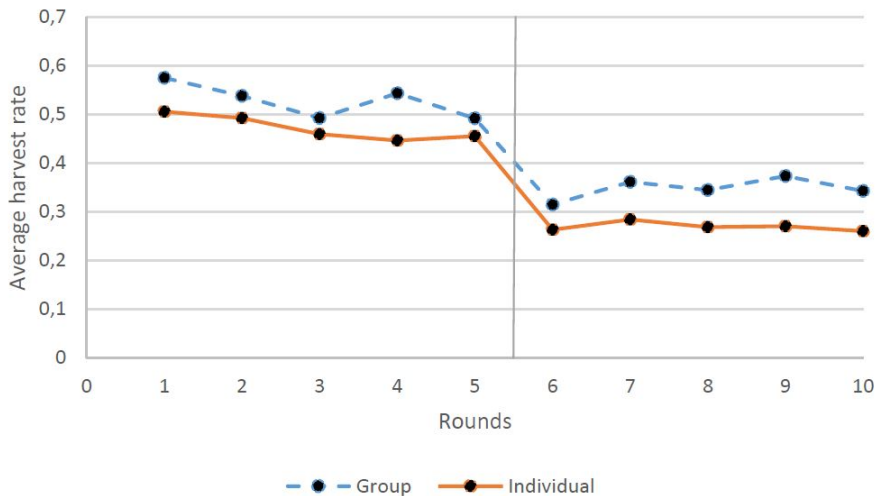- We observe history without policy

Payoff with PES

Individual PES:

$$\pi_{it} = \begin{cases} x_{it} + 2\left(\frac{60 - \sum_{i=1}^{8} x_{it}}{8}\right) + 0.75(RL - x_{it}), & \text{if} \quad x_{it} \leq RL \\\\ x_{it} + 2\left(\frac{60 - \sum_{i=1}^{8} x_{it}}{8}\right), & \text{if} \quad RL \leq x_{it} \leq 5 \end{cases}$$
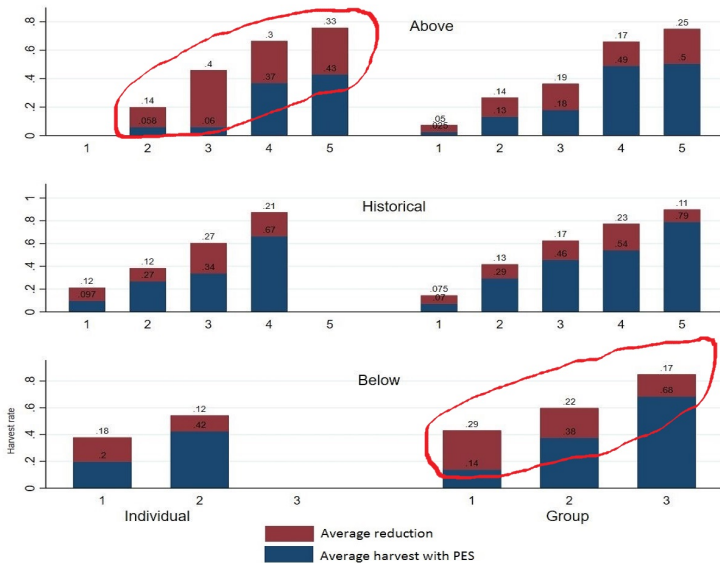
$RL = $ Above | Historical | Below

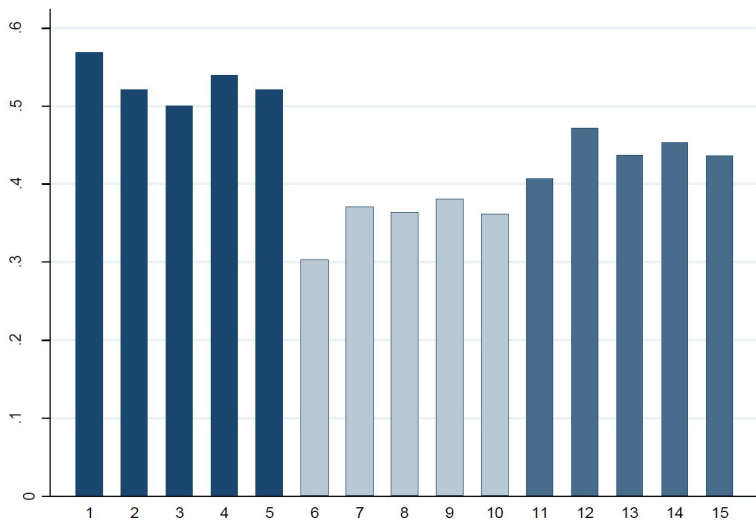- Group PES: $\frac{\sum_{1}^{8} x_{it}}{8}$

With and without PES

Pay type and reference levels

Baseline, PES and post-PES

ABM of FFE data

- previous results are only aggregate values
- address the *how* of behavioral patterns, i.e., mechanism-based explanation
- formalize micro-level mechanisms that generate the phenomenon observed in experiments
- individual behavior affects group outcome, and group behavior affects individual behavior.

ABM of FFE

AgentEx (Schill et al, 2016)

- Cooperation in CPR games
  - focus of experiments
  - trust, communication (reduces social uncertainty)
  - not enough for sustainability (complexity in SES and uncertainty about resource dynamics)
  - environmental uncertainty

- "Cooperation is not enough...for sustainable common-pool resource use"

- sustainable ecosystem management depends on both social-social and social-ecological interactions (both affected by social and environmental uncertainties)

Netlogo
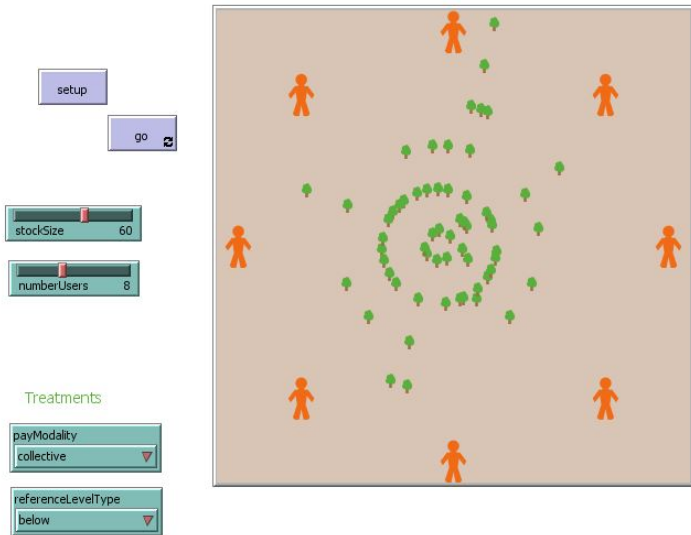
Pseudo-code

- Setup: users and stock (60 trees)
- Harvest: start random
- Identify: assign type (free rider, (un)conditional cooperators)
- Update: group average, others' vs. own harvest
- Reset: show remaining trees and reset stock to 60
- Report: group total, group average, others'

What is next?

- Set rules for harvest (random?)
- Replicate behavioral patterns
- Explain heterogenous responses
- Explain interaction effects in treatments
- Show the role of individuals in group outcome
- Experiment level comparisons

What is next?...

- Can we use *behavior to explain behavior*?
- How to determine types of players:
  - ▶ Free rider: harvest highest or maximum?
  - ▶ Conditional cooperator: start random?
  - ▶ Unconditional cooperator: zero or least harvest?
- Validation?

Thank you!