



Analysis

Resource scarcity and democratic elections in commons dilemmas: An experiment on forest use in Ethiopia

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ABSTRACT

We study the effect of resource scarcity on human behavior using dynamic lab-in-the-field experiments which are framed around the extraction of trees from a communally managed forest in Ethiopia. Subjects who faced resource scarcity were less cooperative than those who faced more abundant commons condition. When initial condition of the commons was relatively abundant it seemed more likely that resource users established a norm of reciprocity. We further found that especially men overharvested under resource scarcity which is in line with studies that had found men to be more competitive. We also tested different policies. We found that gaining legitimacy through election increases cooperation independent of whether the resource is scarce or abundant. When sanctions were imposed we observed a crowding-out effect of intrinsic motivation to cooperate under resource abundance. With resource scarcity imposed sanctions did not lead to a crowding-out effect but democratic elections were by far more effective.

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1. Introduction

In his seminal work “The Tragedy of the Commons”, Hardin (1968) argued that the collapse of commonly used resources ultimately stems from population pressure, and he therefore concluded that population growth should be controlled in order to alleviate the tragedy.¹ While his suggested solutions against “overbreeding” have not gained much advocacy, the impact of dwindling resources on sustainability, inequality, poverty or conflicts remains an issue of debate as well as a key challenge of the twenty-first century. Over the next decades, the process of degradation of natural resources is likely to be accelerated by climate change, “un-damped” population growth, and changes in demand patterns in developing as well as developed countries among others; but the implication of scarcity on human behavior remains an issue of research. Some behavioral experiments have lend support to Hardin’s claim and people do indeed overuse resources if they do not have the

possibility to communicate or make their own rules (Ostrom et al., 1992). However it is unclear whether the social dilemma is harder to overcome when resources become scarcer. Following theoretical arguments by Kramer (1989) and Grossman and Mendoza (2003), who suggested that resource scarcity promotes stronger competition among resource users which widens the gap between own interest and group interest we hypothesize that scarcity increases competition and thus, reduces cooperation. Additionally, we analyze whether different policies to stimulate cooperation are needed under resource scarcity as compared to a situation of resource abundance. We tackle these two questions by investigating cooperation among forest users in Ethiopia within a controlled laboratory environment where natural resource extraction and scarcity are understood and relevant. Scarcity is exogenously induced for random subjects of the experiment, and in a second part of the experiment we test the effectiveness of democratically elected versus imposed rules under relative scarcity and abundance. One might, for example, think that the democratic legitimization is less important under severe resource scarcity where people might feel the need for immediate actions to counter overuse. However, it can also be the opposite.

Scarcity can lead to conflict (e.g. Prediger et al., 2014; Burke and Miguel, 2009; Homer-Dixon, 1999; Hsiang, et al., 2013; Miguel, 2005); but its relation to cooperation has yielded contradictory results so far. While Hardin (1968) implicitly argued that cooperation should linearly

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¹ For example Hardin (1968) writes that “the commons, if justifiable at all, is justifiable only under conditions of low-population density”.

decline with scarcity Ostrom et al. (1999) intuitively argued for a U-shaped relationship.² Uphoff et al. (1990), Bardhan (1993) and Araral (2009) found evidence that the relationship between resource abundance and collective action may have a curvilinear nature. Specifically, cooperation is more difficult for those who should involve in collective action when the common resource is both, extremely abundant (as there is no need to cooperate) and extremely scarce (as individuals see no benefit in cooperation anymore when the resource is close to depletion). According to these studies communities are more likely to cooperate when the CPR is “moderately scarce”. The existing case studies on scarcity and cooperation reported mixed results which are consistent with the non-linear relationship between scarcity and cooperation. However, they mainly focused on scarcity shocks within the same area instead of different endowments of natural resources between areas.³ On the one hand, local communities are reported to care more for the commons when the resource suddenly became scarce and collective action was essential for everybody to survive (Arnold, 1999; Gibson, 2001). On the other hand, Cinner et al. (2011) reported amplifying responses (i.e. fish harder, change location or change gear), thus exacerbating the impact of the resource reduction, from survey experiments with fishermen in Tanzania to hypothetical reductions in resource availability. The increase in appropriation efforts was especially strong for fishermen who had no other option than to fish.

Causal interpretations for long-term scarcity due to different resource endowments have been difficult to conceptualize in the field (see Prediger et al., 2014). Due to this difficulty there has been a small, though growing literature that uses economic laboratory experiments to estimate the effects of scarcity on cooperation levels.⁴ Although using a student subject pool, the most closely related experimental studies to ours are Osés-Eraso et al. (2008) and Osés-Eraso and Viladrich-Grau (2007) where participants had to invest in either a potentially more profitable CPR-market with negative externalities to the other players, or in a private market that yielded stable returns independent of other players' decisions.⁵ Initial scarcity conditions were determined randomly (abundance, some scarcity, and more

² The original literature on common-pool resource management has been rather silent on the impact of scarcity on the propensity for successful collective action. It was neither explicitly mentioned in the initial design principles of Ostrom (1990) nor in the design principles of Agrawal (2002) and Baland and Platteau (1996). Only the recent work of Ostrom (2007) and McGinnis and Ostrom (2014) has included productivity of the system, growth or replacement rate, and the importance of resource dependence as important components of social-ecological systems.

³ Appropriation rules temporarily change under conditions of scarcity in some irrigation communities (Cox et al., 2010). However, such temporary scarcity shocks need to be distinguished from comparison between communities with different resource endowments. People from communities that live under permanent scarcity might be much better adapted to scarce conditions. This can also be exemplified by anecdotes from the right of hospitality among the desert nomadic people or the cooperativeness among whale hunters in the Arctic. Under such harsh conditions where people cannot survive on their own, cooperation is a must.

⁴ Economic experiments are controlled interactions among individuals (based on game theoretic predictions) which are used to uncover causal relationships between treatment and outcome variables (Friedman and Shyam, 1994). Experiments are incentive-compatible since participants are paid money according to their decisions and hence participants have strong incentives to reveal their “true” preferences (Smith, 1982). The use of pecuniary or other material incentive structures make experiments less prone to hypothetical bias or social-desirability biases than surveys (Cardenas and Carpenter, 2005). According to Harrison and List (2004) taxonomy of economic experiments, we will employ art factual field experiments; i.e. laboratory experiments that are conducted within a non-student subject pool.

⁵ Our approach differs in three important ways from Osés-Eraso et al. (2008). Firstly, we use subjects from Ethiopian villages that are more heterogeneous in socio-demographics, have experience with common-pool resources and have strong norms of cooperation in their society. Secondly, in our experiment participants can only reduce their extraction but they cannot choose to invest in another market. The lack of an outside option makes scarcity cognitively more salient and may fundamentally change the way people react to scarcity – even if the theoretical predictions might be similar. Thirdly, participants in both high and low initial forest conditions can potentially earn the same amount of money. If those subjects under scarcity would earn less experimental money than their counter parts with relative abundance, then the difference in behavior could be due to an income effect since people have a decreasing marginal utility from income.

extreme scarcity). Blanco et al. (2011) and Pfaff et al. (2015) carried out their experiments with farmers in Colombia and mainly focused on the effects of resource shocks (different water levels) and the sequence of scarcity instead of different initial endowments. While the studies of Osés-Eraso et al. (2008) and Osés-Eraso and Viladrich-Grau (2007) found more cooperation under scarcity, Blanco et al. (2011) and Pfaff et al. (2015) found less cooperation under scarcity. The diverging results of these studies might suggest that it makes a difference whether experiments on resource scarcity focus on shocks or endowments, are carried out framed or unframed and with students or non-students. Yet, none of these studies investigated the effect of scarcity on (democratic) policies.

Our study closes this important gap by analyzing the effect of sanctions when they become legitimized by the group or not (i.e. by majority voting or imposition) under relative scarcity and relative abundance. The effect of imposed interventions has been studied extensively, and one result is that they bear the risk of crowding-out pro social behavior under certain circumstances (Bowles and Polanía-Reyes, 2012). However, there is strong evidence that rules implemented according to democratic principles, do not lead to the crowding-out of intrinsic motivation to cooperate and are thus more likely to stimulate cooperative behavior and rule obedience.⁶ For example, Bardhan (2000) analyzed forty-eight irrigation systems in India and found that the quality of maintenance was lower when farmers perceived that local elites made the rules for them. By contrast, a positive attitude towards water allocation and high rule compliance was reported among those farmers who responded that the rules had been crafted by the community itself. This highlights the importance of participation in CPR management. But evidence on crowding-out effects from diverse ecological settings is lacking. We hypothesize that given a stronger need for cooperation under resource scarcity; participants may not feel a loss in self-determination due to the imposition of the sanction. Thus, we do not expect a crowding-out effect under resource scarcity. Participants might simply perceive the imposed sanctioning rule as an enabling institution to overcome the cooperation dilemma. We hypothesize that the effects from election are in line with previous studies showing an increase in cooperation under both abundance and scarcity.

The paper has the following structure. In the next section, we explain (i) the experimental design and treatments, (ii) the theoretical predictions and (iii) the study area, background and sample characteristics. Section 3 reports and discusses our results on cooperation under different scarcity treatments and especially on the effects of imposing versus electing rules. Section 4 concludes.

2. Materials and Methods

We implemented a series of experiments with 130 members of a community forest in Ethiopia (randomly grouped into 26 sessions with 5 players each). We intentionally chose Ethiopia for the experiments to capture behavior of real commoners who had experienced scarcity during their lives. We used a framed field experiment on forest extraction to obtain a measure of cooperation. The set-up of our experiment was inspired by a forest harvest game of Cardenas et al. (2013) and Janssen et al. (2013). Both the game as well as some parameters were modified to serve our purpose of analyzing scarcity.⁷ Participants understood the context of the game well because logging is a major source of their income.

Subjects played a dynamic resource extraction experiment in fixed groups of five persons for ten rounds (baseline experiment) followed

⁶ For laboratory experiments see e.g. Ostrom et al. (1992); Decker et al. (2003); Tyran and Feld (2006); Ertan et al. (2009); Dal Bó et al. (2010); and Sutter et al. (2010).

⁷ Modifications made to Cardenas et al.'s (2013) experiment: a) Two scarcity conditions: high and low initial stock; b) Compensation for the conservation effort; c) Increasing the individual maximum allowed from 5 trees to 10 trees and; d) Raising the threshold at which the maximum allowed changes from 25 to 51 trees.

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