Grazing livestock on commonly managed pastures is a widespread practice in post-socialist countries such as Azerbaijan and Georgia. Despite the value of livestock as an important income source for rural households, commonly managed pastures frequently show signs of degradation, pointing to shortcomings in the joint management of common pool resources in those countries. Among other factors, the success of common management crucially depends on the cooperation and self-organization capacity of stakeholders. Especially in post-socialist countries, their capacity and willingness to cooperate in natural resource management is said to be low due to previous experiences of forced cooperation during the socialist period. In this paper, we investigate stakeholders’ capacity to cooperate in natural resource management in two post-socialist countries drawing on a framed field experiment for common pasture use. The analysis of group and individual participant performances show that groups are indeed capable of managing experimental pastures sustainably, especially if participants have the possibility to communicate which, in addition, is positively affecting cooperation. However, we find significant differences in participant performances and decisions between both countries, pointing to differing experiences with real-world pasture scarcity, common pasture management, as well as to differences in social capital endowment and cultural context factors.

Keywords: Comparative case studies; common pool resources; common management; communication; cooperation; culture; decision making; degradation; field experiments; pasture scarcity; participants performance; rangelands

1. Introduction

Field experiments represent a widely accepted way to explore social mechanisms, as well as the strategies and attitudes of actors regarding the collective management of common pool resources (CPR) (Cardenas, Stranlund, and Willis 2016). Experimental research carried out since the 1990s (following Ostrom, Gardner, and Walker 1994) adds further insights into the conditions and mechanisms of collective action concerning CPR and aligns with findings on successful CPR management from case studies of real-life worlds (Ostrom 1990; Poteete and Ostrom 2004). Drawing on a field experiment with real resource users, we aim to contribute further insights to this literature.

It is increasingly recognized in the literature that natural resource management is very site specific (Amirova, Petrick, and Djanibekov 2019). To approximate these local specifics, framed field experiments (Harrison and List 2004) deployed in a deductive manner, together with supplementary social science methods, offer an excellent discovery method for cross-cultural comparisons of CPR management (Beckmann and Padmanabhan 2009). Adopting this application of field experiments, we focus on common pasture use and management in the South Caucasus region.

After the breakdown of the Soviet Union, pastures in the region have undergone shifts in their property regimes influencing pasture use and management practices, in a similar way to those in several Central
Asian countries. These have had a considerable impact on their quality – ranging from severe degradation to underuse (Behnke 2008; Li et al. 2012; Neudert, Rühs, and Beckmann 2015; Raaflaub and Doby 2015; Neudert et al. 2019). The sustainable use of pastures under a commons regime poses particular challenges that are highly dependent on individual and collective decision-making and action capacities. The exploration of these capacities by the application of framed field experiments (Harrison and List 2004) allows light to be shed on the potential of and constraints to real-world sustainable pasture management.

Unequivocally, a standard result in the empirical and experimental studies literature (Cardenas and Ostrom 2004; Cardenas, Rodriguez, and Johnson 2011) is that communication – a treatment also included in our experiments – is among the factors that have been shown to enhance the sustainable common management of resources (Lopez and Villamayor-Tomas 2017; Cardenas 2003; Ghate, Ghate, and Ostrom 2013). Yet, social dilemma experiments on common pool resources have demonstrated that, even without communication, actors in game situations do not behave as selfishly as economic theory predicts (Anderies et al. 2011; Prediger, Vollan, and Frölich 2011; Ghate, Ghate, and Ostrom 2013; Falk et al. 2010; Casari and Pott 2003). In fact, communication has the potential to increase cooperation (Lopez and Villamayor-Tomas 2017; Ghate, Ghate, and Ostrom 2013).

Many studies provide evidence that the motivation to act cooperatively in an economic experiment varies strongly and is affected by various individual characteristics of participants, such as the degree of individual selfishness or the willingness to personally contribute to a public good (Henrich et al. 2004), as well as contextual factors such as socialization, culture, historical experience, and also the political and ecological environment (Röttgers 2016; Castillo et al. 2011; Falk, Lohmann, and Azebaze 2016; Anderies et al. 2011). In particular, real-world resource scarcity might influence actors’ behavior in the experimental setting (Janssen et al. 2012). However, although scholars have shown that in experimental and field settings context affects cooperation and may be more important than individual propensities (Gurven et al. 2008; Ghate, Ghate, and Ostrom 2013), it is often difficult to disentangle different contextual factors.

Although cross-country comparisons can yield insights into contextual factors that influence behavior, comparative sets of studies are rare (c.f. Castillo et al. 2011). Prediger, Vollan, and Frölich (2011, see also Vollan, Prediger, and Frölich 2013), for example, state strong effects of social, cultural and ecological variables on participant decisions, but admit having great difficulty differentiating between them. The present comparison of field experiments on common pasture use for different case study sites in Georgia and Azerbaijan aims at providing further insights to facilitate differentiation.

By presenting experiments conducted in two post-Soviet countries that shared similar historical experiences before gaining independence in 1991, our study allows further exploration of how contextual factors, such as differing recent political environments, socio-cultural traits or ecological factors, affect cooperation.

In order to compare and analyze individual decisions and group performances in Georgia and Azerbaijan, a field experiment with a stable experimental setting containing two treatments (with and without communication), drawing on modified classical CPR experimental settings by Cardenas and Carpenter (2008) and Prediger, Vollan, and Frölich (2011), was chosen to explore site-specific/contextual factors, that might differ between the two countries. Thereby, the design of the experiment also allows for a comparison with previous experiments, besides being explorative with regard to context factors.

While most published experiments investigate fisheries, forest use, or irrigation (Janssen et al. 2012; Basurto et al. 2016; Kosfeld and Rustagi 2015; Gurven et al. 2008; Poteete and Ostrom 2004; Janssen, Bousquet, and Ostrom 2011), only a few publications deal with the specifics of pasture use (exceptions are Prediger, Vollan, and Frölich 2011; Vollan, Prediger, and Frölich 2013). This is surprising because pasture resources, like fisheries and forests, are a major resource with common pool characteristics. By investigating the potential of and constraints to common pasture use, our experiment thus adds further insights into the specifics of common use on pastures.

The experiments presented in this paper are to our knowledge among the few (Gerkey 2013) on pasture use conducted in post-Soviet countries. There are, however, more experiments conducted on other CPR in this area (e.g. Amirova, Petrick, and Djanibekow 2019; Baerlein, Kasyrov, and Zikos 2015; Gachter and Herrmann 2011). Amirova, Petrick and Djanibekov (2019: 11), who are among the first to conduct experiments on cooperative water users in Central Asia, find evidence against the stereotype that the “(...) self-organising power of citizens in the post-Soviet societies is underdeveloped”. Similarly to their results, we find that the option to communicate within the group of users increased the capability and willingness of individuals – or, how Amirova et al. (2019) frame it, the commitment – to engage in the management of CPR in a statistically significant way.

The complexity and multitude of context variables in the design of the study reinforce the call for field experiments aiming at a deeper understanding of real-world determinants and individual motivations for
227

decision making and cooperation (c.f. Anderies et al. 2011; Röttgers 2016). Lopez and Villamayor-Tomas (2017), by exploring the impact of context by means of a content analysis of the communication process during field experiments in rural Colombia, show that the quantitative results from the field experiments become more comprehensible when the qualitative data are analyzed. Consequently, there is an ongoing research interest in, and need to effectively bridge, quantitative and qualitative research approaches. In view of this, we also go beyond existing methodological approaches by combining quantitative results from field experiments in Azerbaijan and Georgia with qualitative anthropological methods of data collection (questionnaires and participant observation). In doing so, we aim at an enhanced understanding of the role of context in communication for CPR management.

2. Study Area

The comparative study focuses on six mountain villages in two neighboring regions – Kakheti in Georgia and Ganja-Gazakh in Azerbaijan – of the South Caucasus region allowing for the study of differing socio-cultural influences as well as the political and ecological contexts in the countries (Table 1).

The two countries share a similar socio-political history with a post-socialist transition background (Roland 2000) but more recently their economic and political paths have diverged. The dissolution of state and collective farms followed by a far-reaching privatization of agricultural land and machinery started in Georgia in 1992 and in Azerbaijan in 1996 (Lerman 2006). While in Azerbaijan the economy has experienced a recent boom fueled by oil and gas exports, service-oriented sectors such as tourism are more important for the Georgian economy (State Statistical Committee of Azerbaijan 2017; National Statistics Office of Georgia 2018). Agriculture, in terms of its contribution to gross domestic product (GDP), is comparable in both countries: in Azerbaijan it amounted to 5.8% of GDP in 2018; in Georgia to 6.7% of GDP (World Bank 2019). Moreover, employment in the sector is similarly important and high in both countries (World Bank 2019), and thus plays an important role in securing livelihoods and as a basis for food security in the countries.

Climatic conditions in the two study regions are similar with a temperate climate and precipitation of between 550 and 800 mm/yr (https://en.climate-data.org for study village locations). Both regions have a strong focus on stationary and mobile livestock keeping. The focus of this paper is on the problems and challenges of stationary livestock keeping on common village pastures (Allahverdiyeva 2017; Salzer 2016). Livestock keeping is of high socio-economic importance since it provides a subsistence livelihood and income for a large part of the rural population. Thus, common village pastures represent an important resource for the rural population (Neudert et al. 2019; Didebulidze and Plachter 2002; Allahverdiyeva 2018). However, the ecological condition of pastures in both countries is worrying (Table 1).

Table 1: Major similarities and differences between the study regions.

|                                | Azerbaijan                  | Georgia                      |
|--------------------------------|-----------------------------|------------------------------|
| Agro-climatic conditions       | Temperate climate and precipitation of between 550 and 800 mm/yr ¹ |                              |
| Historical background          | Post-soviet transition, privatization of the agrarian sector in the 1990s² |                              |
| Social capital/social          | Strong bonding, low bridging social capital, kin-group based forms of social organization | Bonding and bridging social capital present Stronger emphasis on individualistic and choice-driven social organization ⁴ |
| organization                   | Strong focus on social norms³ |                              |
| Governance approaches to       | Responsibility of the local self-administration authority (Belediye) and local residents, no further regulations are provided⁵ | Legal situation pending, no formal management authority, de-facto open access situation⁶ |
| common pasture                 | High socio-economic importance⁶ |                              |
| Importance of livestock         | Overuse and erosion widespread⁷ | Overuse in vicinity to villages, coexists with underuse and reforestation in remote parts⁸ |
| keeping and pasture use        |                             |                              |
| Pasture condition              |                             |                              |

Sources:
¹: https://en.climate-data.org for study village locations; ²: Roland 2000; ³: Valiyev 2011; ⁴: Hough 2011; ⁵: Neudert et al. 2020; ⁶: Neudert et al. 2019; Allahverdiyeva 2018; Didebulidze and Plachter 2002; ⁷: Neudert et al. 2013; Babayev 2007; ⁸: Raaflaub and Dobry 2015.
Besides the outlined similarities, there are differences in contextual factors such as culture, society, religion, and recent resources-related policy in the countries that provide a reason for differing approaches towards cooperation in CPR management. Recent governance approaches to common pasture use differ substantially—despite the fact that village pastures are currently administered by the state in both countries. In Georgia, the procedures regarding common village pasture land are pending in a de-facto open access situation, and there is no formal management responsibility at the local level. In Azerbaijan, the management of common village pastures is the responsibility of the local self-administration authority (Belediyye) and local residents, but no further regulations are provided by the state or designed locally. Hence, the approach in Azerbaijan can be termed a pseudo-collective property regime. In practice, de-facto rules for pasture management and care are not found in Azerbaijan or Georgia (Neudert et al. minor revisions). Thus, in both countries, the situation regarding common village pastures exhibits major shortcomings in the management of common resources and collective decision making.

In addition, since resource users had negative experiences with forced collectivization in the socialist system, they are reported to have reservations about new forms of collective management regimes (Beckmann, Otto, and Tan 2015; Mearns 1996). Due to a history of centrally planned cooperation, people may have little incentive to take responsibility for the peer-governance of a CPR. In addition, pre-socialist knowledge and experiences with commons management might be lost or overwritten. These aspects constitute major obstacles to cooperative commons management.

Today’s wider political environment, in which local formal and informal institutions are embedded, differs between the two countries. In Georgia it can be described as a semi-presidential representative democratic republic with a multi-party system, vibrant non-governmental organization (NGO) sector and a clearly expressed commitment to join the European Union EU. In contrast, the role of the state in the presidential republic of Azerbaijan can be characterized by an authoritarian regime, a strong accumulation of power considerably restricting civil society activities, and restrictive and punitive regulations on NGOs and foreign organizations. Furthermore, whilst in Azerbaijan, the population is predominantly Muslim, the majority of the Georgian population is Christian. These traits play an important role in informing values and norms and thus also modes of social interaction, but also inform people’s attitudes toward innovations, collective action and participation abilities, which eventually puts a significant imprint on the type of governance of CPR (Salukvadze 2008).

Similarly to many other successor states of the Soviet Union, Azerbaijan and Georgia are often characterized as countries with “high bonding” and “low bridging” social capital, i.e. high levels of in-group trust and cooperation and low levels of generalized trust between social groups (Valiyev 2011; Hough 2011; Bourdieu 1983; Putnam 1993). However, differences regarding bridging social capital can be observed. While in Azerbaijan bonding social capital is the prevalent form of capital, bridging social capital is reported to be virtually absent (Valiyev 2011). Apart from external restrictions on civil society activities, the concentration on kin-group based forms of social organization is considered to hinder the development of grassroots communities.

### Table 2: Baseline data of case study villages.

| District name | Study villages in Azerbaijan | Study villages in Georgia |
|---------------|-----------------------------|----------------------------|
|               | Shemkir | Göy-Göl | Gedebey | Akhmeta | Sagarejo | Telavi | Arashenda |
| Village name  | Atabey | Keremli | Plankend | Shakhvetila | Gombori |  |
| Altitude (m a.s.l.) | 1,300 | 996 | 1,450 | 680 | 1,150 | 760 |
| Total number of households | 186 | 97 | 276 | 89 | 655 | 720 |
| No. of households permanently living in the village | 117 | 80 | 221 | 85 | 285 | 355 |
| No. of households engaged in livestock keeping | 97 | 69 | 168 | 83 | 150 | 78 |
| Total pasture area (ha) | 863 | 517 | 94 | 411 | 1,846 | 350 |
| Pasture area (ha/household) | 4.64 | 5.33 | 0.34 | 4.62 | 2.82 | 0.49 |

1: Data for the administrative unit of a municipality, which comprises several other villages in addition to the case study village.
2: As additional data indicated that the grazing pressure in Keremli is higher than in Atabey due to higher livestock numbers per household (Neudert et al. 2019), we assigned Atabey to have the least pasture scarcity.

Source: (Allahverdiyeva et al. 2015) based on local and statistical information.
democratic organization (Valiyev 2011). In Georgia, on the contrary, bridging social capital is of relative importance and is underlined by an openness toward new actors, social entrepreneurs, and the participation in democratic processes and grassroots civil society organizations (Hough 2011). In times of economic difficulties in particular, kin-group based forms of social capital serve as a form of informal insurance (Hough 2011) and important means of survival.

The experiments were conducted in three villages in each region located in an altitudinal belt of 650–1,600 m above sea level where stationary livestock keeping with common pastures prevails (Allahverdiyeva et al. 2015). Within the framework of a broader interdisciplinary research project, the study villages were selected along a gradient of pasture resource scarcity (Table 2). This allowed us to study the impact of real-world experience of scarce pasture area on participants’ decisions in the framed field experiments. As an indicator for depicting varying levels of scarcity of common village pastures, the pasture area per household was calculated (Table 2, see also Neudert et al. 2019).

3. Experimental design and analysis
3.1. Rationale and expectations

While most early experiments on common pool resource management took place in a laboratory setting without reference to a real-world resource management problem (Ostrom, Gardner, and Walker 1994), framed field experiments (Harrison and List 2004) increasingly draw on local participants and refer to a specific resource (Ghate, Ghate, and Ostrom 2013; Anderies et al. 2011; Janssen et al. 2012; Cardenas 2003; Henrich et al. 2001; Cardenas and Carpenter 2008). Thus, for making decisions in a framed field experiment, participants can draw on their real-world experiences with resource management.

Cardenas and Ostrom (2004) distinguish three information layers that influence participant decisions: (1) The material payoff layer contains information on rules, payoffs, and strategies as well as knowledge provided on round outcomes in the course of the experiment. (2) The group context describes aspects that are shared knowledge in the group, such as norms, identity or heterogeneity. (3) The identity layer is the location for individual information on the participants, such as age, education and occupation. Also located on this layer are preferences and values that are not influenced by the co-participants. Thus, in making a decision during the experiment, participants use information from the experimental situation itself, but also draw on cultural or social norms and values and previous knowledge.

That communication enhances cooperation in CPR experiments is widely known from the literature. Participants are offered the opportunity to devise their own rules for the continuation of the experiment as well as to verbally encourage or discourage the behavior of co-players. Thus, they are commonly able to achieve results closer to the social optimum (Anderies et al. 2011).

The effect of communication, however, can be modified through the presence of information from the identity and group layers (Castillo et al. 2011). Shared norms may discourage egoistic incentives and thus partly substitute for the communication effect (Ghate, Ghate, and Ostrom 2013; Kerr, Vardhan, and Jindal 2012). This effect is found to be particularly strong if the experiment is framed according to actual resource use for which institutions exist (Lesorogol 2007) and participants are themselves experienced resource users (Cardenas 2011). Thus, communication is expected to have a positive effect on cooperation and sustainable pasture use in the experiment.

Participants’ decisions are influenced by actual resource use practices and ecological dynamics (Anderies et al. 2011). Experiments with actual resource users have repeatedly shown that participants bring in their own experiences, leading to somewhat mixed effects of treatments such as communication and punishment (Anderies et al. 2011, Castillo et al. 2011). The study of Ghate, Ghate and Ostrom (2013) thus indicates that, given that participants draw on extensive prior knowledge about resource use, internalized norms have a higher impact on behavior than communication. In their case, communication led to a homogenization of participant decisions. Prediger, Volland and Frölich (2011) also conclude that in Namibia the experience of a sensitive ecological environment leads their participants to more restrictive stocking decisions and thus better performance. Given that participants in Field Experiments in Azerbaijan and Georgia most likely draw on their real-world experiences with pasture use it can be assumed that real-world pasture scarcity leads to more cooperative behavior of participants.

On the group layer, social capital is an important factor influencing trust among participants and thus the level of cooperation. Social capital is rather difficult to measure during field experiments (Anderies et al. 2011). However, the importance of history and cultural predispositions for experimental outcomes is indicated especially by cross-country studies (Takahashi et al. 2008). In related cross-country studies, Volland (2008) and Prediger, Volland and Frölich (2011) find higher levels of cooperation and inter-personal
trust in Namibia compared to sites in Southern Africa, whereas in Namibia traditional resource use rules were largely intact. For irrigation experiments comparing Kazakhstan and Uzbekistan, Amirova, Petrick and Djamibekov (2019) find higher contributions in the Kazakh study sites, which are characterized by an absence of traditional water management schemes but the setting-up of collaborative schemes since the 1990s.

Focusing more on single aspects of beliefs influencing cooperation, group identity and within-group trust is shown to influence cooperation. Cardenas and Ostrom (2004) find a lower impact of communication if participants believed that the “State” should manage the local resources, but a negative reaction to externally imposed sanctions if participants were members of community organizations.

The review showed that characteristics of culture on the group and identity layer can modify the impact the communication effect. Background information on the study show that we find a higher level of bridging social capital in Georgia than in Azerbaijan, which might affect communication.

Moreover, the cultural context of Georgia and Azerbaijan is likely to influence individual and group context variables.

### 3.2. Design and implementation

The grazing experiments implemented in this study are primarily based on the protocol of fishery and rangeland experiments (Prediger, Vollan, and Frölich 2011; Cardenas, Rodriguez, and Johnson 2011). Prediger, Vollan and Frölich (2011) adopted the design for pastures to reflect the inter-temporal dynamics, path-dependency, spatial variability (heterogeneity of resource availability), and non-linear payoffs of grazing in rangelands.

The experiments were implemented with five participants for each session, who remained unchanged in their group composition (Appendix 1). The experiment was conducted with two treatments, each lasting for 10 rounds: treatment I without communication; treatment II with communication. In each round, the participants could decide to “graze” one of two experimental pastures (pasture A or B). The participants could choose between three different grazing intensity levels (no grazing (0), low (1) and high intensity (2)), resulting in different individual payoffs. In addition, individual and group payoffs were dependent on the quality of the pasture (good or bad) resulting from use in the previous rounds. If in one round on one pasture the carrying capacity (sum of grazing intensities by all participants = 5) was exceeded, the pasture quality changed from good to poor for the next two rounds, representing degradation. In consequence, the payoff per participant from grazing on a poor pasture is reduced significantly, and the carrying capacity (maximum total stocking rate) should not exceed 1. If the respective depleted pasture (A or B) was grazed below the carrying capacity of 1 for two rounds, it recovered back to a good condition. The optimal strategy thus involves four participants in each round choosing grazing intensity 2 and one participant choosing intensity 1. Given that the choice of pastures is coordinated, none of the experimental pastures is depleted. Starting treatment II (with communication), participants could engage in an initial and/or ongoing discussion during the experimental rounds.

Self-administered questionnaires (Appendix 2) were provided at the end of the experiment to bridge the gap between the abstract experimental situations and local real-world experiences. The questionnaire comprised closed and open questions on the socio-economic background of participants, their real-world experience with pasture use, and personal attitudes plus feedback and perceptions of the participants regarding the experimental situation. This additional information aimed at providing an in-depth understanding of individual and group motivation.

Supplementary qualitative data were collected by participant observation during the course of the experiments, which included participants’ verbal and nonverbal communication, roles (e.g. taking over the lead), decisions (i.e. whether participants were reaching mutual agreement), and reactions to the developments of the experiment, as well as interactions and discussions between participants themselves and with the moderator. Following a guideline with a coarse structure, direct participant observation of the experiment was documented in structured protocols by the same enumerator in both countries for later qualitative analysis.

Participants were selected based on the criterion of the temporary availability of five people at once. In some of the villages, the process was facilitated by the local administration or voluntary helpers and their recommendations. In other villages, the selection of participants followed the snowball principle or was facilitated through public announcements by posters. Attempts were made to engage and encourage different stakeholder, age, and gender groups of the respective villages. Therefore, different approaches were employed to obtain a balanced sample – e.g. to actively involve women by visiting them in their homesteads,
or purposefully searching at gathering places for different age groups. Each participant received a symbolic amount of credit (1 Azerbaijan New Manat (AZN) or 1 Georgian Lari (GEL), equal to approximately 0.3–0.5 EUR) for cellular phones as a reward for their participation. The experiments were led by facilitators proficient in the local language supported by an assistant for documentation and the leader of the experiment, for whom the experiments were translated (consecutively) into the English language.

In total, the sample size amounted to 43 experiments (24 sessions in Azerbaijan and 19 in Georgia) and participant observations with a total of 215 participants (4,300 experimental observations) and questionnaires answered (Table 3). The experiments were conducted in August and September 2016. The sample is comparable regarding socio-demographic data on age to country indicators. Despite the efforts to engage women in the experiments, the share of female participants is lower than in the general population. However, since men predominantly take herding tasks, the sample can be considered as typical for persons involved in livestock-related decisions.

### 3.3. Analysis

Statistical analysis of quantitative data for group performances and participant decisions were performed using Excel and STATA 15. Group performances were analyzed using bivariate techniques such as t-test on the equality of means. If distributions were not equal according to the Kolmogorov-Smirnov test, the unequal variant of the t-test was chosen in STATA. For ordinal-scaled data, Pearson’s Chi-squared is reported (StataCorp 2018).

The analysis of group performances focused on three dimensions of sustainability in the experiment: (1) participant payoffs (economic performance); (2) percentage of experimental pastures in good condition (ecological performance); and (3) inequality of participant payoffs within a session (social performance). The latter simple inequality measure is calculated as:

$$I_{s,t} = \frac{PO_{\text{max}} - PO_{\text{min}}}{PO_{\text{mean}}}$$

Where I is the inequality index of a certain session and treatment, $PO_{\text{max}}$ and $PO_{\text{min}}$ are the maximum and minimum payoffs of individual participants in that session and treatment, and $PO_{\text{mean}}$ is the mean payoff in that specific session and treatment. Thus, a high inequality index indicates high differences between session participant payoffs. This simple inequality indicator based on the range between maximum and minimum values is appropriate for our purpose given the small sample size (N = 5) and presence of statistical certainty (Cowell 2011).

For participant decisions, ordinal logistic regression models for panel data were used (StataCorp 2018). Due to the strong differences between the countries (see results on group level), the model was run separately for the datasets from Azerbaijan and Georgia, but the same set of variables was used. We developed sequential models for testing for the impact of communication, ecological context and the cultural context in detail. Socio-economic variables (age, gender, and familiarity with resource use) were used as control variables. Variable descriptions and further justifications of variable choice can be found in Appendix 3.

Questionnaires and participant observation protocols were transcribed so that qualitative data could be comparatively analyzed based on the situational analysis approach developed by Clarke (2012). This approach entails techniques for coding, conceptualization and categorization of data in an iterative

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1. Fewer experiments conducted due to unavailability of 5 people at once.

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1 The median age is 31.3 years in Azerbaijan and 38.1 years in Georgia (2017 estimates, Indexmundi 2019).

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### Table 3: Sample size of economic field experiments.

| Unit                  | Study villages in Azerbaijan | Study villages in Georgia |
|-----------------------|------------------------------|----------------------------|
|                       | Atabey | Keremli | Plankend | Shakhvetila | Gombori | Arashenda |
| Number of experiments | n      | 8       | 8        | 8           | 3       | 8         | 8         |
| Number of participants| n      | 40      | 40       | 40          | 15      | 40        | 40        |
| Age (average)         | years  | 31.3    | 29.6     | 28          | 42.6    | 29.1      | 36        |
| Gender (female participants) | percent | 13     | 30       | 39          | 47      | 56        | 30        |

1: Fewer experiments conducted due to unavailability of 5 people at once.
process that makes it possible to include different types of data and their comparison (also with quantitative data). Qualitative variables for the analysis such as “reaching mutual agreement”, or the “jointly elaborated rules” were obtained by employing the respective techniques.

4. Results

4.1. Group performances

4.1.1. Statistical results by treatment and country

In the treatment without communication, the group of participants in each experimental session achieved a mean payoff per participant of 53 points or 68% of the optimum payoff. In addition, in 60% of the cases on average the experiment pastures were in good condition. The inequality index, which measures the differences between the payoffs of individual participants in a group reached 0.45.

All indicators significantly improved in the treatment (II) with communication. The mean payoff per participant increased to 66 points (84% of the optimum), on average 87% of the experimental pastures were kept in good condition, and the inequality index decreased to 0.32. Thus, in the treatment with communication, the experimental results for the dimensions payoffs, pasture condition, and equality for both countries were better (ttests p < 0.01 for payoff and pasture condition, ttest p < 0.05 for equality). Thus, at the experimental level, we find evidence concerning the impact of communication on cooperation and sustainable pasture use in the experiment.

However, the results show that the effects of communication were significantly different between Georgia and Azerbaijan. The mean payoff per participant result (Figure 1) increased significantly more in the experiments conducted in Georgia from, on average, 65% to 91% of the optimum payoff, while the Azerbaijani participants could improve their results from, on average, 71% in treatment (I) without communication to 81% of the optimum in treatment (II) with communication. While we find no differences in payoff means between the countries in the no communication treatment (ttest p > 0.10), results differ with communication (ttest p < 0.01). This suggests that communication had a larger effect in the Georgian experiments for approaching the optimum payoff.

A comparison of the percentages of pastures in good condition reveals further phenomena: without communication, Azerbaijani participants managed to keep a higher proportion of experimental pastures in good condition, while with communication groups in both countries achieved similar results (Figure 2). Figure 4, which illustrates the percentage of pastures in good condition over the course of the experiment, shows this result clearly. While without communication results differ between the two countries (ttest p < 0.01), no differences were found in the communication treatment (ttest p > 0.10). This suggests that, in the Azerbaijani sessions, in the treatment without communication, participants acted more carefully and avoided degrading the experimental pastures. Participants obviously relinquished part of their payoffs to achieve good pasture quality.

On viewing the results for the inequality index, further details of the results become obvious (Figure 3). The differences between session participants’ payoffs are larger for the Azerbaijani experiments for both

Figure 1: Boxplots of mean payoffs per participant by treatment and country. The optimum payoff is 78 points.
Figure 2: Number of pastures in good condition by treatment and country. The maximum and optimum value is 20.

Figure 3: Inequality index measuring differences between group participant payoffs by treatment and country. A high inequality index indicates large differences between group participant payoffs.

Figure 4: Percentage of pastures in good condition during the experiment by country and treatment.
treatments, while in the Georgian sessions a significant improvement towards lower inequality in the treatment with communication is achieved. Results between countries differ for both treatments (without communication; t-test p < 0.05; with communication t-test p < 0.01).

4.1.2. Qualitative aspects of the role of communication and rule development

Beside the mere presence of communication, we observed whether groups achieved a mutual agreement on a strategy and could implement it in the subsequent rounds. Although lively discussions – sometimes entirely off topic – took place during most of the sessions in the case study villages, 60% of the participating groups in the Georgian study villages and 40% in Azerbaijani study villages failed to reach a mutual agreement. However, whether an agreement was reached or not did not directly relate to participant payoff, pasture quality, and inequality indicators. In cases in which mutual agreement could be reached, the outcomes were different: a) mutual agreement could be reached, and participants adhered to their self-developed rules; b) although mutual agreement was reached, and jointly elaborated rules were established, uncoordinated behavior of individual actors could be observed, since individuals did not implement the rules as agreed. This can most probably be explained by the short-term benefit seeking of single individuals. Thus, even though agreement was achieved more often in the Azerbaijani groups, the performance of the Georgian groups improved more often. This suggests that the mere presence of communication or its encouragement has a greater effect than whether a mutual agreement was reached or not, although there was no mechanism for enforcing agreements.

Furthermore, participant observation of the experiments revealed that in many experiments in both Azerbaijan and Georgia, one person took the lead to facilitate or coordinate the strategy (for treatment II) – visible, for example, in an individual instructing the session participants in what to do, examining the decisions of all participants before their realization, or waiting until all the others had taken their decision in order to adapt their own decision to it.

The rules jointly elaborated by participants can be divided into pasture-related rules and stocking rate-related rules. In some cases, both types were combined, sometimes only one type was agreed upon. Pasture-related rules regulate the access of participants to the experimental pastures by either fixed assignments, e.g. “ Lets divide into two groups: two people go on one, three on the other pasture” (A3/3, Azerbaijan), “Three people on pasture A, two on pasture B” (K1/K5, Azerbaijan), or solutions with mostly one, but sometimes also all, participants alternating between pasture A and B (e.g. A1, Georgia). Rules related to agreements on stocking rates per participant are more diverse. Rules aimed mostly at careful hedging strategies or sacrificing behavior by one person (this person constantly deployed 0 or 1). In some cases, sacrificing behavior was requested by co-participants or participants suggested this themselves. Some groups decided to sacrifice payoffs for all participants in order to avoid pasture degradation, e.g. “If we put only one animal per person on the pasture, we earn 7. Better not to put two and earn 8 but deplete the pasture.” (K1/1, Azerbaijan). Still other groups developed a fair play strategy by deciding on turns in sacrificing behavior – e.g. “One zero, others two and then we change” (P5/5, Azerbaijan) or “One cow for one person, the others two” (P7/P3, Azerbaijan). Combining pasture-related and stocking rate-related rules, participants developed schemes for alternation between pastures in combination with a prescribed stocking rate.

4.2. Participant decisions

4.2.1. Determinants of participant decisions – quantitative analysis

Differences in experimental results between countries are further corroborated when looking at results for choices of intensity levels. Participants could decide to choose the intensity levels zero, one, or two. An intensity level of two implied high payoffs but also a high risk of degrading the pasture, while an intensity level of zero meant no payoffs but also no risk of degradation. On average, participants played zero 1.3 times (13.5% of the cases) in the treatment without communication and 0.8 times (8.0% of the cases) in the treatment with communication. However, Figure 5 shows that participants in Azerbaijan chose zero significantly more frequently than the participants in Georgia (14.6% in Azerbaijan compared to 5.9% of the cases in Georgia). On the contrary, Azerbaijani participants chose the highest intensity of two less frequently, independent of the treatment (Chi-squared > 0.01, Figure 6).

This confirms the obviously careful strategies of Azerbaijani participants aimed at conserving pasture quality, and at the same time the significant improvements achieved by communication in the Georgian experiments. In the latter, the optimum distribution of stocking intensity was more often reached, where none of the participants chose zero. Thus, differences in group performances are obviously deeply rooted in participant intensity choices, which warrants further investigation.
Deteriorants for the decisions of participants were investigated in econometric models for Azerbaijan and Georgia (Tables 4 and 5, Appendices 4 and 5). The grazing intensity per participant and round was the outcome variable. This can be two, one, or zero. The models sequentially introduce variable sets to investigate the impact of communication, ecological context, in particular real-world resource scarcity, and cultural context.

Concerning the impact of communication, the reduced models with the communication effect only (GE1 and AZ1) confirm the pure communication effect. The size of marginal effects and coefficients (Appendix 5) confirm that the communication effect is stronger in Georgia than in Azerbaijan. The effect of communication is significant in all models, while it is overruled by experimental pasture quality for the Azerbaijani study villages (see below). The effect of control variables is negligible and insignificant, with keeping livestock on village pasture having the highest, yet still small, effect for the Georgian models.

Concerning the impact of real-world pasture scarcity, the second models (GE2 and AZ2) show that pasture resource scarcity is significant in the Azerbaijani models, with robust estimates even when other variables are included. This indicates that participants experiencing higher real-world pasture scarcity play two fewer times in the experiment in the Azerbaijani villages. The variable also has a negative sign in the Georgian models as expected, though it is insignificant. Thus, the models provide support for the conjecture from literature that real-world pasture scarcity leads to more cooperative behavior of participants for the Azerbaijani study.
That participants reacted to the ecological incentive in the experimental design is confirmed by the highly significant effect of experimental pasture quality in all models. The model shows that, when the experimental pasture quality is good, participants are more inclined to play two, i.e. to apply the highest possible stocking rate. The experimental pasture quality mitigates the effect of communication in Azerbaijan, indicating that experimental pasture quality is more relevant for participants’ decisions than communication (AZ3). Though experimental pasture quality is also relevant for the Georgian models, it occurs alongside the communication effect (GE3).

The next set of models (AZ4 and GE4) investigates the individual and group context variables associated with attitudes and culture on the decisions. The variables played with strategy and trust in co-players have only negligible impacts on the participants’ decisions, influence of others is significant for the Georgian model only. As the effect is negative, influence of others led participants to choose grazing intensity two less frequently. Thus, we find evidence that cultural context factors in the different countries moderately affect individual and group context variables on decisions in the way that the influence of co-players was more important in the Georgian model. This is consistent with the overall larger communication effect in the Georgian model.

Table 4: Determinants of participants’ decisions on grazing intensities in Georgia.

|                                | Reduced Model GE1 | Reduced Model GE2 | Reduced Model GE3 | Reduced Model GE4 | Full Model GE5 |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|----------------|
|                                | Marginal effect   | Marginal effect   | Marginal effect   | Marginal effect   | Marginal effect   |
|                                | (Std. Err.)       | (Std. Err.)       | (Std. Err.)       | (Std. Err.)       | (Std. Err.)       |
| Communication                  | 0.19 (0.022)***   | 0.19 (0.022)***   | 0.07 (0.026)***   | 0.18 (0.027)***   | 0.07 (0.032)**   |
| Socio-economic control variables |                   |                   |                   |                   |                 |
| Age                            | 0.00 (0.001)      | 0.00 (0.001)      | 0.00 (0.001)      | 0.00 (0.002)      | 0.00 (0.002)     |
| Gender                         | 0.01 (0.050)      | 0.00 (0.050)      | 0.00 (0.051)      | 0.01 (0.066)      | −0.02 (0.067)    |
| Keeping livestock on village pastures | −0.01 (0.051)  | −0.05 (0.056)    | −0.06 (0.057)    | −0.06 (0.074)    | −0.07 (0.075)   |
| Ecological knowledge (real world) |                 |                   |                   |                   |                 |
| Pasture resource scarcity      | −0.05 (0.037)    | −0.06 (0.038)    | −0.01 (0.072)    | −0.04 (0.073)    |                 |
| Ecological knowledge (experiment) |             |                   |                   |                   |                 |
| Experimental pasture quality (current round) | 0.16 (0.017)*** |                   |                   | 0.16 (0.021)***  |                 |
| Individual and group characteristics |                   |                   |                   |                   |                 |
| Played with strategy           | 0.01 (0.070)      | 0.02 (0.071)      |                   |                   |                 |
| Influence of others            | −0.15 (0.078)*   | −0.16 (0.079)**   |                   |                   |                 |
| Trust in co-players            | −0.03 (0.090)    |                   | −0.05 (0.091)    |                   |                 |
| Model statistics               |                   |                   |                   |                   |                 |
| Observations                   | 1660              | 1660              | 1660              | 1060              | 1060            |
| Wald Chi-squared               | 65.50             | 67.17             | 139.67            | 45.34             | 94.42           |
| Log Likelihood                 | −1343.75          | −1342.86          | −1304.65          | −878.99           | −852.88         |
| Pseudo R squared               | 0.15              | 0.15              | 0.17              | 0.44              | 0.46            |

Ordered probit estimation for panel data with the outcome variable “grazing intensity played”. Shown are average marginal effects for grazing intensity two, similar conclusions are obtained from the marginal effects for intensities one and zero (Appendix 2 for full model). For variable definitions and justifications see Appendix 3.

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels.
4.2.2. Qualitative analysis of real-world experiences influencing experimental decisions

The qualitative analysis of data from questionnaires and protocols from participant observation underlines and further illustrates the influence of real-world experience on behavior in the experiments.

Although formal/informal institutions of common pasture management do not appear to be in place in any of the case study villages, common herding is practised in all villages. For most of the case study villages, around 80% of the participants stated in the follow-up questionnaire that they were currently involved in joint herding activities. Only participants from two villages (one per country) reported lower rates of active cooperation in herding. Although the motivation for collaborating in joint herding generally differs from village to village, a divide between Azerbaijan and Georgia becomes visible. While, in Georgia, rules, agreement (informal institutions) and property regimes seem to be the most important factors for joint commons management, in Azerbaijan, social (social networks and emotional bonds) as well as individual needs and benefits are predominantly stressed. In addition, participants’ statements throughout the experiments often refer to socio-cultural factors such as shared values and norms or social cohesion – exemplarily illustrated by a statement commenting on participants’ cautious behavior with respect to their applied grazing intensities: “Kind hearted neighbors would never do something bad to each other”

Table 5: Determinants of participants’ decisions on grazing intensities in Azerbaijan.

|                              | Reduced Model AZ1 | Reduced Model AZ2 | Reduced Model AZ3 | Reduced Model AZ4 | Full Model AZ5 |
|------------------------------|------------------|------------------|------------------|------------------|----------------|
| Communication                |                  |                  |                  |                  |                |
| Socio-economic control variables | 0.04 (0.019)**  | 0.04 (0.019)**  | −0.01 (0.019)    | 0.05 (0.020)**   | −0.01 (0.020)  |
| Age                          | 0.00 (0.002)     | 0.00 (0.002)     | 0.00 (0.002)     | 0.00 (0.002)     | 0.00 (0.002)   |
| Gender                       | 0.00 (0.054)     | 0.01 (0.053)     | 0.01 (0.054)     | 0.02 (0.061)     | 0.02 (0.062)   |
| Keeping livestock on village pastures | 0.01 (0.134) | −0.01 (0.132) | −0.01 (0.134) | −0.01 (0.147) | 0.02 (0.150) |
| Ecological knowledge (real world) |                  |                  |                  |                  |                |
| Pasture resource scarcity    | −0.05 (0.026)*   | −0.07 (0.027)**  | −0.05 (0.030)*   | −0.07 (0.030)**  |                |
| Ecological knowledge (experiment) |                  |                  |                  |                  |                |
| Experimental pasture quality (current round) | 0.24 (0.019)**  |                  |                  | 0.24 (0.020)**  |                |
| Individual and group characteristics |                  |                  |                  |                  |                |
| Played with strategy         |                  |                  | −0.02 (0.066)    | −0.01 (0.067)    |                |
| Influence of others          | 0.02 (0.048)     |                  | 0.01 (0.049)     |                  |                |
| Trust in co-players          |                  | 0.02 (0.067)     | −0.03 (0.069)    |                  |                |
| Model statistics             |                  |                  |                  |                  |                |
| Observations                 | 2060             | 2060             | 2060             | 1840             | 1840           |
| Wald Chi-squared             | 5.83             | 9.01             | 151.39           | 8.94             | 140.13         |
| Log Likelihood               | −1915.02         | −1913.44         | −1839.68         | −1705.35         | −1637.27       |
| Pseudo R squared             | 0.16             | 0.16             | 0.19             | 0.25             | 0.28           |

Notes: Ordered probit estimation for panel data with the outcome variable “grazing intensity played”. Shown are average marginal effects for grazing intensity two, similar conclusions are obtained from the marginal effects for intensities one and zero (Appendix 2 for full model). For variable definitions and justifications see Appendix 3. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels.
Statements of participants also underline that real-world experience of pasture condition is reflected in the experiment e.g. “We are thinking for the others [fellow villagers] as well. (...) If the number of animals rises [in the village] there is not enough fodder and the pasture is overgrazed” (K8/1). And after a couple of rounds the same participants expressed their gladness about the regeneration capacity of the experimental pasture and the economic effect of it with “Now we have milk again” (K8/2, Azerbaijan). A similar statement from Georgian participants not only refers to pasture productivity but also to previous experiences with pasture depletion due to undergrazing and the importance of pasture care: “A good pasture provides a lot of good milk and thus outcome. A bad pasture provides a bad outcome. [in regards to undergrazing:] If there are not enough animals, sometimes the land is cultivated, or the ground turned, otherwise a lot of poisonous plants appear” (A6/3, Georgia). Another group of participants thought that if they – even before the pasture degrades – consistently put fewer animals on the experimental pasture than the maximum stocking rate allows for, or if they let one of the experimental pastures rest, a higher number of animals would be able to graze on those pastures in the following season (A4, Georgia). Hence, they followed the logic of rotational grazing and pasture recovery.

When directly asked for parallels between the experimental setting and their real world, participants’ perceptions varied greatly. Whilst some participants saw no parallels at all – e.g. “No. I have no idea about what goes down on our pastures” (A2/1, Georgia) – other participants emphasized aspects such as: “[the parallel is:] (...) trying not to deteriorate the pasture” (A4/5, Georgia); “(...) trying to make better use of the pastures” (G1/5, Georgia); “(...) taking turns between the two pastures, letting the other rest” (A4/4, Georgia), “When one pasture is deteriorated the owners take their cattle to another one” (G4/2, Georgia). Thus, the statements underline that during the experiment participants referred to their personal experience of pasture use, including their observations of pasture quality. This aligns with the statistical result that real-world pasture scarcity influences participants’ decisions in the experiment. In turn, participants asked for their evaluation of the field experiment revealed different motivations and interests, as well as specific aspects of knowledge, self-reflection, and learning on the subjects of mutual agreement, and communication and thus cooperation in common pasture management: “The reflection of our agricultural practice is interesting for us” (At1/2, Azerbaijan), “I liked the fact that we were doing our best to communicate each other’s livestock plans” (G5/1, Georgia) or “I liked it [the field experiment]. The game [experiment] makes it very clear, how profitable it is for everyone to act in mutual agreement” (S2/5, Georgia) or “(...) on the basis of mutual agreement the deterioration of pastures can be evaded” (A3/5, Georgia) but also: “It [the field experiment] was (...) underlining the issues crucial to the village” (G5/2, Georgia).

5. Discussion
In this paper, we have investigated stakeholders’ capacity to cooperate in natural resource management in post-Soviet Georgia and Azerbaijan and explored contextual factors influencing it using a framed field experiment for common pasture use.

5.1. Discussion of methodology
We adopted an experiment on pasture use by Prediger, Vollan and Frölich (2011) and Cardenas, Rodriguez and Johnson (2011) to investigate the impact of cultural and ecological context in a post-Soviet country on cooperation in a CPR dilemma. We conducted 43 experimental sessions in two countries, which yielded a comparable sample size to that in other field experimental studies (Prediger, Vollan, and Frölich 2011; Amirova, Petrick, and Djanibekov 2019; Castillo et al. 2011). Although participant selection was constrained by practical considerations of the availability of villagers, the sampling approach, as well as considerations of representing different age and gender groups, is similar to that in other field experimental studies (Prediger, Vollan, and Frölich 2011; Amirova, Petrick, and Djanibekov 2019; Castillo et al. 2011).

Adding qualitative evidence further helped to understand participant decisions and corroborated the statistical analysis. Thus, we see more potential in complementing field experimental studies with qualitative data in mixed-method studies (Lopez and Villamayor-Tomas 2017). Notwithstanding, in participant observation specifically, the discipline-based interests and obligations of a researcher shape what is considered relevant, and hence provide for a subjective part (Emerson, Fretz and Shaw 2001), one of the key qualities is the ability to discover aspects that would remain invisible by only focusing on standardized protocols.

2 The corresponding question was: “Did you like something particular in the “game”? If, so what?”


5.2. Discussion of results

The analysis of group and individual participant performances has shown that groups are indeed capable and willing to manage the experimental pastures sustainably, especially if participants have the possibility of communicating. This is in accordance with the results of CPR experiments with similar designs carried out in the field of economics since the 1990s (Cardenas and Ostrom 2004; Cardenas, Rodriguez, and Johnson 2011). Given that the communication treatment was always applied as the second manipulation, which was also done in most preceding studies, the observed effect may include learning, besides the pure communication effect (Lindahl, Bodin and Tengo 2015). Other studies have furthermore demonstrated that allowing for communication has a positive impact on equity measured in payoff (Ghate, Ghate, and Ostrom 2013), which in the Georgian cases becomes significantly evident in the equality indices. Looking at the indicators “play two” and “play zero”, in accordance with Ghate, Ghate and Ostrom (2013) field experimental results from India, our results for the Georgian cases also show that communication tends to homogenize individual and group outcomes. In addition, we could show that, although no mutual agreement could be reached, continuous communication appeared to be a successful strategy in keeping group grazing intensities below the carrying capacity.

The study provides further insights into the influence of social, cultural, and ecological context variables which differ by country. The data indicate that the strategies chosen by the participants differ from the beginning. In the Azerbaijani experiments without communication in particular, a high rate of pastures in good condition – 60 to 85% – was found. For the same experiments, Prediger, Vollan and Frölich (2011) found that the percentage of pastures in good condition ranges between 30 and 0% for South Africa and 30 and 60% for Namibia. This indicates an even higher capacity for successful common pool resource management in Azerbaijan than in Namibia and South Africa. In the rounds without communication particularly, the Azerbaijani participants acted more carefully, paying attention not to cause pasture degradation. A possible explanation, as indicated also by the econometric model, is the real-world grazing pressure on pastures, which is higher in Azerbaijan than in Georgia (Neudert et al. 2019). A further possible explanation could be that, according to Gerkey (2013), shared cultural values and norms and institutions increase cooperation, especially when they emerge from economic interdependence which in Azerbaijan, due to the absence of bridging social capital, is an important factor shaping social interaction.

The results for Georgia indicate that participants bring in less real-world experience, shared norms and values from the beginning, but that they are capable of solving the CPR dilemma and establish cooperation once communication is possible. That “influence of others” – a socio-cultural variable – had a positive impact on cooperative behavior for the Georgian cases provides further support for this explanation. Thus, the results also further reinforce findings stating a broader range of social capital in Georgia which entails bridging forms social capital for establishing cooperation and an openness towards participation in democratic decision processes (Hough 2011, Valiyev 2011). In contrast, the Azerbaijani cases show that mutual agreement does not necessarily lead to equally higher payoffs for the session participants. At the same time, the analysis of participant decisions showed a considerably higher rate of choosing intensity level zero, pointing to the sacrificing behavior of individual participants. A potential explanation for such behavior is offered by Ghate, Ghate and Ostrom (2013) who find subjective cooperation already in the first treatment without communication. They explain this behavior by culturally deeply embedded shared values and norms. Hence, communication is not necessarily a precondition for the adoption of cooperative decisions. This could provide an explanation for participants’ decisions in the Azerbaijani cases.

These preliminary findings have shown that communication modified experimental behavior of the participants in both countries in different ways, providing further evidence that contextual factors strongly influence behavior (Cardenas and Ostrom 2004). However, given that many factors in the comparison between the two countries co-vary and that the experiments were explorative, these insights into contextual factors have to be treated with caution and should be subject to further testing in repeated experiments.

5.3. Real-world management implications

In view of the above, and in an attempt to outline a vision of the potential and conditions of real-world common pasture management, it can be stated that there is potential for common pasture management in both of the South Caucasian countries. Our examination of the participants’ performances in the field experiments in Azerbaijan and Georgia demonstrated that villagers can act cooperatively, especially when encouraged to mutually discuss and self-organize, despite the notion that cooperation tends to be particularly low in post-Soviet countries. Similarly to the results of Amirova, Petrick, and Djanibekov (2019)
from Uzbekistan and Kazakhstan, our results provide evidence that actors are in fact able to design rules for CPR management endogenously and thus also that policies that provide local users with a certain degree of autonomy in decision making and action have the potential to work in Georgia and Azerbaijan.

However, a precondition for cooperation, coordinated action, and potential rule development is ownership in the sense of security of access to a resource which relates to the wider political context. This is particularly challenging in the Georgian cases. While responsibilities and ownership of village pastures and management are theoretically clear in Azerbaijan, the unclear legal situation of village pastures in Georgia creates a lack of sense of ownership and agency, and thus a lack of management responsibility, although locally collaboratively coordinated pasture management seems to be highly feasible.

The development of a vision for strengthening collective pasture management should be based on locally existing forms and styles of cooperation as shown by the experiments and the accompanying qualitative research, reflecting site-specific factors, particularly opportunities and limits resulting from social norms and values, as well as experiences with real-world resource use. Hence, joint action and a solution to coordination problems in pasture management could be best addressed by the joint establishment of locally adapted and accepted rule designs (c.f. also Baerlein, Kasymov, and Zikos 2015) for pasture use, based on sound information (on the state of the resource; local dynamics etc.).

For the case study villages, the field experiments have shown that there is a tendency among participants to entrust their decisions and behavior to actors who have assumed a leading role in facilitating or coordinating strategies. This provides for the assumption that “leadership” is an appreciated and accepted adoption of roles in Azerbaijan as well as in Georgia. If this assumption proves to be correct, the strengthening of collective pasture management might operate best through accepted informal or formal social leadership, or so-called social “change agents” (Rogers 1962) assigned a clear mandate by the community (Hurrelmann, Murray, and Beckmann 2006). Crucial for these facilitators, often encountered in the form of informal drivers and carriers of knowledge in local communities, is their understanding of local specifics, but also of the challenges of coordinated action. Neither power dynamics nor conflicts have been investigated in the framework of this study although, according to Baerlein et al. (2015), such studies would offer important complementary perspectives on the CPR management in post-Soviet countries. Hence, besides knowledge of the local landscape, gaining an in-depth understanding of the local social dynamics that facilitate or hinder action or change is central to any further steps – in research or practice – aiming at facilitating cooperative pasture management.

Additional Files
The additional files for this article can be found as follows:

- **Appendix 1.** Experimental protocols. DOI: https://doi.org/10.5334/ijc.953.s1
- **Appendix 2.** Post-experimental questionnaire. DOI: https://doi.org/10.5334/ijc.953.s2
- **Appendix 3.** Variable definitions and justifications. DOI: https://doi.org/10.5334/ijc.953.s3
- **Appendix 4.** Marginal effects for grazing intensity one and zero. DOI: https://doi.org/10.5334/ijc.953.s4
- **Appendix 5.** Model coefficients. DOI: https://doi.org/10.5334/ijc.953.s5

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Competing Interests
The authors have no competing interests to declare.
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