Wageningen University: Environmental Economics and Natural Resources Group

Conflict under resource scarcity

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Abstract

Due to the recent rise in conflict, it is important to see how the international community can help alleviate and prevent these occurrences of violence. Recently, in reports by international organizations, but also in academic literature, the link between scarce environmental resources and violent conflict is made. This link, however, is mostly made on the basis of case-studies and is being described as incredibly complex. Therefore, it is useful to take a look at this link in a controlled environment, in order to see whether environmental conservation could be used to create stability in all conflict-prone situations, regardless of context. In order to do this, this thesis analyses the connection between resource scarcity and conflict through an economic experiment, conducted with 64 subjects, who were all a member of a Scouts association. Resource scarcity was modelled as a lower initial resource pool and conflict as punishment decisions made by the subjects. The results show no direct link between initial resource pool and number of punishment decisions. They do show a link between the difference in points between players and punishment decisions. This could be linked to a perception of unfairness or inequality leading to more conflictive behaviour, as has already been described in the current body of literature as well.

1. Introduction

Indicators of violence, such as direct deaths in war, military spending, terrorist incidents and numbers of displaced populations, have all risen dramatically since the beginning of this century (World Bank, 2018). From this, it is apparent that (violent) conflict is an increasing problem. Conflict has long-lasting and extensive consequences, such as a delay in further development of states in which it takes place (HDI, 2018). Not only does conflict slow down progress, it can also set countries back. After conflict is resolved, it can take years, or even decades for that country to reach pre-violent levels of development (HDI, 2018). For example, between 2012 and 2017, the conflicts in Syria, Libya and Yemen contributed to these countries' slipping down the Human Development Index, due to significant declines in their life expectancy or economic setbacks (HDI, 2018). This is why it is important to analyse the mechanisms behind these conflicts, and to see how these conflicts can be prevented, resolved or alleviated.

One of the specific contexts in which violence manifests itself is in resource-related disputes. Resource related contestations can take place at multiple levels: Between herders and farmers over access to arable and grazable land, between communities over allocation of irrigation water, between citizens and the state over the displacement impact of a new dam, and between neighbouring states over the sharing of transnational waters (UN + WB, 2018, p.152). Most violent conflict related to water takes place at the local level (UN + WB, 2018, p.152). Degraded landscapes increase demand and pressure on limited shared resources. The timing, quantity and quality of water supply necessary for development relies on healthy ecosystems to underpin these services. Ecosystems also provide direct livelihood opportunities for example through the provision of food, raw materials and medicine. However, sustained modification of natural landscapes over time has compromised the services and benefits that humans derive from ecosystems – a by-product of population growth and economic development coupled with poor environmental stewardship (Vörösmarty et al., 2013). For example, wetlands, which are especially important due to their relatively high biodiversity, show an estimated decline of about 35% in both marine/coastal and inland natural wetland areas studied between 1970 and 2015 (Ramsar, 2018). Annual rates of wetland loss show acceleration since 2000, accounting for an overall total loss of 70% of the world's natural wetland area since the turn of the century (Ramsar, 2018).

Resource scarcity is also becoming an increasingly big problem, due to climate change and mismanagement of natural resources. Climate change functions as a 'threat multiplier' and worsens already existing situations of resource scarcity caused by exploitation and mismanagement of these resources (Van Baalen and Möbjork, 2017). A resource that can well illustrate the increasing trend in natural resource scarcity is water. More than 2 billion people live in countries experiencing high water stress (UN water, 2018a). Water stress "is a measure of the pressure that human activities exert on natural freshwater resources, providing an indication of the environmental sustainability of the use of water resources" and "defined as the proportion of water withdrawal by all sectors in relation to the available water resources" (UN water, 2018a, p. 7). Although the global average water stress is only 11 percent, so 11 percent of the total water in the country is withdrawn from the available water resources (UN-water, 2018b). 31 countries experience water stress between 25 per cent - this is the starting amount at which water resources are no longer sustainably used - and 70 per cent (UN-water, 2018b). 22 countries use more than 70 per cent of the available water resources and are seriously stressed (UN-water, 2018b). Water stress affects every continent, hinders sustainability, and limits social and economic development. "A high level of water stress can result in negative effects on economic development and food security, increasing competition and potential conflict among users" (UN-water, 2018a, p.15). This means that both conflict and scarcity are currently major themes in international development, and there is a link to be drawn between the two.

Currently, focus of the international community is mostly focussed on conflict mitigation and rehabilitation (UN+WB, 2018 & OECD, 2018). A shift away from managing and responding to crises and towards prevention of conflicts can save lives and greatly reduce the cost of conflict mitigation. In comparison to the amount currently spent on crisis response and reconstruction, investing more in prevention can lead to an average global net savings are 5 -70 billion USD per year (UN+WB, 2018). In addition, conflict prevention can also generate benefits, by preventing land degradation, and lowering the likelihood of a relapse (UN+WB, 2018). "In a conservative, neutral scenario where only 50 percent of efforts at prevention prove successful, the net returns from prevention are US$33 billion against an average cost of US$2.1 billion per year over 15 years. Put another way, for each US$1 invested in prevention, about US$16 is saved down the road" (UN+WB, 2918 p. 2-4). Despite these benefits, currently only 12% of Official Development Assistance in conflict-prone contexts is spent on conflict prevention (2%) and peacebuilding (10%) (OECD, 2018).

In the light of the increase in conflict, and an increase in attention for conflict prevention, it is interesting and relevant to analyse whether there is a direct link between resource scarcity and conflict. As this could better help us understand the effect of scarcity on conflict, which might create a new strategy for preventing and mitigating conflict, namely addressing resource scarcity. Since conflict prevention is not only ethically, but also financially more beneficial than crisis response and reconstruction, the current strategy, it is useful to look into these kinds of conflict prevention possibilities. If there is a direct link between resource scarcity and conflict, preventing resource scarcity might be a less politically sensitive, effective way of preventing and alleviating conflicts.

In this thesis, the research question "Is there a direct and general link between resource scarcity and conflict or are specific contextual variables more important to explain this link?" will be answered. The research presented in this thesis shows that the link between resource scarcity and common pool resources is presented as very complex, situation dependent and non-linear (Benjaminsen & Ba, 2019; Brottem, 2016; Van Baalen & Mobjörk, 2017; Linke et al., 2017; Seter, 2016 & Sterzel et al., 2014). Therefore, it could very well be possible that a direct link cannot be found. However, all these studies do show that resource scarcity and conflict are somehow linked. This especially because it is recently acknowledged by practitioners in the field, such as relevant UN bodies (UN-water, 2018a, 2018b, and

UN+WB, 2018). Testing the hypothesis in a controlled environment can eliminate these complex contexts and allow us to test the direct link between conflictive behaviour and scarcity. This allows us to see if the common denominator, namely a link between resource scarcity and conflict, between these studies actually exists. Based on the research presented above, I hypothesise that in situations in which scarce resources are present, this scarcity increases the chances that people will engage in violent conflict.

Since the link between resource scarcity and conflict has so many contextual variables in case-studies, it is difficult to focus on understanding a direct link. A controlled environment, where variables are in the hands of the researcher, helps to eliminate this varying context. In order to do that, an economic experiment is a useful tool, since in this situation the confounding variables can be more controlled and therefore the direct relationship between conflict and the abundance of scarcity becomes more apparent. Therefore, this thesis uses an economic experiment to address the research question.

This thesis does not find a direct link between conflict and resource scarcity. Likely because contextual variables, are more important to explain why people engage in conflict. The data presented does, however, suggest that there is a link between perceived inequality and resource scarcity. This link has been suggested in other previous research as well, such as by Must (2016) and the United Nations and World Bank “Pathways to Peace” report (2018).

2. Literature Review

It is clear that the relation between resource scarcity and conflict is acknowledged and on the agenda of several international organizations, but how clear is the direct link between resource scarcity and conflicts? Several studies show the link between conflict and resource scarcity in practice. For example, Sosnowski et al. (2016) find that more pronounced dry seasons coincide with clashes between different ethnic groups in the Sudd wetland in South Sudan. DeJuan (2015) finds that there is a robust correlation between where environmental change takes place and where violence occurs. For example, a lot of violent action occurs around the edges of the Sudd Wetland, were vegetation cover changes frequently. He concludes that future long-term ecological change will likely contribute to violence in many areas of the world. Several other quantitative studies have identified a link between lack of rainfall, land cover, fire and conflict, as explained by Brottem (2016). Brottem (2016) also explains that qualitative political ecology related studies find a more complex link, including institutional weaknesses, local grievances and ethnic tensions. He states that the link between conflict and resource scarcity could be based more on these factors than on environmental degradation. An example of one of these studies is done by Benjaminsen and Ba (2018), who find that the reason for joining jihadist groups for many pastoralists is that they are disgruntled by policy programmes that lead to loss of pastures and blocked livestock corridors and further politically marginalized.

However, there are also quantitative studies that show not such a robust link. For example, Linke et al. (2015) try to link rainfall variability to local peoples' perception of violence in rural Kenya. They found little evidence that a worsening drought is associated with increased support for the use of violence and thus conclude that the relationship between the two might exist, but is not direct and needs to be understood in varying local/contextual conditions (Linke et al., 2015). Sterzel et al. (2014) use a large-n global study to conclude that the relationship between armed conflict distribution and increased drought is non-linear. This link is explained as being influenced by the varying importance of poverty and resource overuse depending on the state of the soil and water resources (Sterzel et al., 2014).

Since the complexity of the link between violent conflict and resource degradation is acknowledged, it is important to see how this link is explained, both theoretically and in case studies which have identified confounding variables. Several studies theorize on the link between resource degradation and conflict. Seter (2016), names one specific link between ecosystem degradation and violent conflict, namely economic hardship due to ecosystem degradation. This states that "economic considerations are the foundation for individuals when they make a cost–benefit evaluation about joining violent action" (p. 4). She does not deny the consideration of other social factors, but finds that these economic considerations are at the heart of individual's decisions (Seter, 2016). Van Baalen and Mobjörk (2017) identify different ways in which resource scarcity and conflict are linked:(1) worsening livelihood conditions, (2) increasing migration and changing pastoral mobility patterns, (3) elite exploitation of local grievances and (4) tactical considerations by armed groups.

Other research shows how important cultural conflict resolution institutions are when effects of climate change affect communities. A zoom-in on the complexity of the link between ecosystem degradation and conflict is done by several studies, who find different types of relationships between conflict and resource scarcity, for example inter-community grievances and traditional and new institutions. Institutional peace-making alone will not function if inter-community grievances are not taken into account (Kaufman, 2006). The maintenance of traditional ways of distributing and coping with land rights is crucial to proper management of marginal land, and a top-down approach does not function as well as supporting these traditional institutional structures (Raleigh, 2010; Mohammed & Beyene, 2015). Mohammed and Beyene (2015) have found that traditional conflict resolution is

effective 90% of the time, but this is within the same community, not between communities. Linke et al. (2018) explain how cultural institutions have managed inter- and intragroup relations during periods of scarcity in Ethiopia. Tessema et al. (2013) note that conflict management institutions are important for sustainable pastoralism. It is also important to note that inclusive and representative institutions do not result in conflict when resources are scarce; exclusionary institutions do have this effect (Lecoutere et al., 2010). It might also be important to note the difference in ethnic groups in size and political importance, smaller, politically insignificant ethnic groups experience relatively more conflicts than the bigger groups (Raleigh, 2010). The vulnerability of these groups is also shaped by their political institutions, which could be related to clashes (Raleigh, 2010). Another factor of importance is the possibility of communication between conflicting parties, which mostly leads to less conflict (Mohammed & Beyene, 2015).

This thesis differs from the research presented above, since it uses an economic experiment. This type of research offers the opportunity to eliminate the confounding variables and the complexity that is present in case-study dependent research that is presented above. Of these games, common pool resource games are quite common, and these are very suitable to model resource availability, since most natural resources that are currently scarce, such as water and grazelands, are common pool resources. There have been games in the past that try to model people's behaviour under conflict, but these do not link conflict to resource scarcity. Bornstein (2003), for example, had groups of people compete against each other in different games, and measured conflictive behaviour under different communication strategies. Another example is Hugh-Jones and Leroch (2017), who measured whether people reciprocate harmful behaviour against a group, if they are affected by one of its members. Others do play a common pool resource game and have a separate conflict mechanism (Safarzynska, 2018). Here, conflict is modelled as punishment, since punishing a partner is conflictive behaviour and call for retributive behaviour, but it can be included in a common pool resource game, as is done by Lecoutere et al. (2010), Melo and Piaggio (2015) and Prediger et al. (2013). Scarcity is modelled as a lower initial common resource pool, as is done by many experiments that research the effect of scarcity on common pool resources (e.g.: Rutte et al., 1987; Osés-Eraso & Viladrich-Grau, 2007; Blanco et al., 2012; Varghese et al., 2013). This means that the initial pool of resources that can be drawn upon is lower in the scarcity situation, meaning there is less resource to initially share. In this case it is easier for the resource to be depleted, and that the benefits that can eventually be derived from the resource are also lower. The experiment conducted in this thesis is described in the following section.

3. Methods

3.1. Experimental Design

3.1.1. Public Goods Game

The first part of the experiment is based on the methods used by Osés-Eraso and Viladrich-Grau (2007), who also create a common pool resource experiment based on scarcity, combined with the methods of and Isaksen et al. (2018) who also create a game in which messages are conveyed to participants without using a pre-set programme, with some added changes. The aim of this game is to test conflictive behaviour incidences under two treatments, one with scarcer resources than the other. In this experiment, participants play a repeated one-shot public goods game. This means that every game is independent from the previous one, but it is repeated seven times per participant, against randomized and anonymized opponents. Each participant receives an endowment of an *e* amount of tokens that can be invested in project A, denoted in the instructions as the "private project" option, or not invested. The amount invested by agent *i*, *i*= 1, …, n, in project A is defined as x_i. The participant cannot invest more than their entire endowment, so $e \geq x_i$ The remaining size of resource at the end of the game (*Fr*) is defined as:

$$(1)\quad F_{R=}F_0 - c\sum_{i=1}^{n} x_i$$

In which F_0 is the resource pool at the start of the game, *c* is defined as the reduction in the common pool resource, and *n* is the number of agents. And the payoff function (π_i) is defined as:

$$(2)\quad \pi_i = wx_i + \frac{F_R}{n}$$

In which *w* denotes the earnings from each token invested. This means that wx_i denotes the returns for agent *i* from the private project and $\frac{F_R}{n}$ are the final returns that agent *i* receives from the equal distribution of the remaining resource after investment.

It is important to note that the values of *w* and *c* need to be determined in order to create a social dilemma. Investing in project A should be more efficient for the individual, while not investing in project A, if both players take the same route, leaves both players with greater returns. This makes not investing the socially optimal option. Investment in project A can thus be explained as appropriation from the common pool resource, agent *i* obtains a private marginal benefit, *w*, at cost *c*. The cost is shared by all players. This means the individual marginal net benefit of investing in project A is $\left(w - \frac{c}{n}\right)$. Based on this, the values : *n*=2, *c*=3 and *w*=2 were selected and we can predict the dominant strategy (Nash equilibrium).

Table 1 Individual returns of investing 1 token per player

Player A \ Player B	Invests	Does not invest
Invests	-1,-1	0.5, -1.5
Does not invest	-1.5, 0.5	0,0

From the table presented above, we can see that the investment decision is a "prisoner's dilemma", since there is a socially sub-optimal Nash equilibrium. We can see that investing tokens is the dominant strategy, since not investing when the other player does not invest generates a larger loss than when both players invest. This means that investing the entire endowment € the individual

optimum. We can also see that the social optimum exists when both partners do not invest, since the overall loss is the least, so the gain from the remaining resource is overall the greatest.

3.1.2. Punishment

To simulate conflict, we use the punishment mechanism. After playing the Public Goods Game, players get the opportunity to punish each other. Players will pay a cost of z out of their earnings to diminish the pool of the other player harvesting from their common pool by g. Here z= 5 and g=20. Since there is no gain for agent i if he or she punishes someone, the individual optimum is not to punish. The social optimum is also not to punish, since this diminishes the total number of points in the game (depletes the common pool resource).

3.1.3. Scarcity

Scarcity in the model is captured by changing the initial resource stock level F_0. We describe two treatments, T1 in which $F_0 = (ce)+(n(z+g))$. In this situation, c=3, e=20, n=2, z=5 and g=20. This means that the amount of points in F_0 is equal to: (3*20)+(2*(5+20))= 110. In this situation, if one player invests fully in project A and the other invests nothing in project A, and both players punish, one of them does not receive any points, so the lowest possible achievable score is 0. This is the more scarce situation. The other treatment labelled T2 situation has a common pool twice as big as the scarcity situation, so F_0=220. This is the less scarce situation.

3.2. Experimental procedure

Participants consisted of a group of 64 members of the *Scouting Driesprong* scouts association in Breda, The Netherlands. This group was selected because of their high levels of social coherence. Participation in formal groups, such as the Scouts, is associated with increased civic involvement and increased sense of community (Albanesi et al., 2007). This sense of community is very important in simulating these conflict environments, since violent conflict often takes place between communities, not individuals. Their age varied from 15 to 54 years old, their levels of education varied from VMBO-level high-school to MSc degrees. The participants consisted of 42 men and 22 women. Age skewed more towards to younger side of the aforementioned bracket (mean=23.19, SD=7.35).

The participants received instructions to the experiment to read, but were also instructed face-to-face the received instructions can be found in Appendix A. After instructions they were able to ask questions to the instructor. After finishing the instruction round, they took a small test to test their knowledge of the game. If a participant made mistakes, the instructor talked to the participant to verify knowledge of the game until the participant was able to answer all questions correctly themselves. The questions are included in the instructions found in Appendix A. Participants were also asked a number of questions on their background in the Scouts association, to use as demographic variables in the analysis.

After this, participants were partnered up in groups of 2 to conduct the experiment. To limit communication between participants, the rest of the experiment was conducted via WhatsApp messages, whilst the participants were not necessarily in the same place. The messages sent to the participants can be found in annex B. It could not be controlled that participants did not discuss the experiment amongst themselves via WhatsApp or in person. They were urged not to, but this cannot be guaranteed. The experiment started with an individual message from the instructor, informing participants how big the common pool (F_0) they received was, and asking how much of their endowment (e) they would like to invest (x_i). Participants sent a message to the instructor of the experiment stating how much they wanted to invest in project A (x_i). After this, they were informed about their own and their partners' payoff (π_i). Following these results, they could both choose whether or not to punish the other player. They messaged this decision to the instructor. When both

decisions were received, players were informed about whether they had been punished or not, including the final amount of points per player. This is one round of the game. After this, participants are matched up with a random other participant and the round is played again. Each participant played 7 rounds, one every day for a week following the instructions. Players were still allowed to WhatsApp questions to the instructor if things were unclear.

Two treatments were employed. One in which F_0=110, one in which F_0=220. For both experiments the following values were adhered to: n=2, c=3, w=2, e=20, z=5 and g=20.

Statistical analysis, through linear and probit regression, of the results is done through R version 3.6.1, using the Rstudio UI, and the Stargazer and AER packages. The alpha value taken in order to determine statistical significance is 0.1.

4. Empirical Specification

4.1. Punishment and common pool size

4.1.1. Models

In order to answer the question whether punishment is influenced by scarcity, the link between scarcity and the amount of punishment in the model must be analysed. Since we want to analyse the conditions effect on punishment, this is our dependent variable. It is also a binary variable. A Probit model is used, since it restricts $Pr(\ (Y = 1|X_1, \ldots X_k)$ to lie between 0 and 1. This model will try to fit an S-shaped curve to the data, since binary data always assumes an S-shaped curve, estimating the best possible relationship. In a Probit model, the cumulative standard normal distribution function $\varphi(.)$ is used to model the regression function when the dependent variable is binary. This means the basic model looks like this:

$$(3)\quad E(Y|X) = Pr(1|X) = \phi(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n)$$

In the first set of models the dependent variable is punishment, the independent variable varies and β are the regression coefficients. The null hypothesis for all these models is $\beta_{1,\ldots,n}=0$, which means that there is no relationship between the dependent and the independent variables. The first model (Model 1) in this set takes common pool size as the independent variable. The second model (Model 2), adds more demographic-type characteristics, namely age, gender and time at the Scouts association as independent variables, to see if these influence this relationship. Another model (Model 3) was made which included the round of the game as a dependent variable. It analysed the relationship between punishment and common pool size per round, in order to see whether the tendency to punish changed over time in the game. Model 2 and 3 were also combined, creating Model 4, where demographic variables were added as well as the variable in which round the punishment took place. In a fifth model (Model 5), the relationship between punishment and common pool size was determined per participant, in order to see whether there is a strong correlation between punishment and common pool size for specific participants.

4.1.2. Hypotheses

The hypothesis for model 1 is that there is a relationship between common pool size and punishment, namely that if the common pool size is smaller, as is the case in T1, more punishment is exerted. The hypothesis for Model 2 is that (1) women punish less, since men are more likely to hurt others to advance their interests (Burnham, 2018); (2) older participants punish less, since individuals are better able to regulate their behavioural responses to interpersonal problems as they age (Birditt & Fingerman, 2005); and (3) that people who are at the scouts association for a longer time punish less, since they experience a higher level of social cohesion. The hypothesis for Model 3 is that punishment increases over time, as observed by Osés-Eraso and Viladrich-Grau (2007). They also see an increase in conflictive behaviour as the game progresses. Melo and Piaggio (2012) find that people punish in reaction to being punished in the previous round, seeing an increasing trend. The hypotheses for Model 4 are the same as in model 2 and 3. The hypothesis for model 5 is that punishment actions are approximately the same across individuals, since there are no contextual variables that can influence their decisions, such as personal grudges. The results of these analysis are presented in the results section below, except for Model 5, due to the size of this table it is added in annex C.

4.2. Punishment and investment

4.2.1. Models

In addition to the relationship between the common pool resource, the relationship between punishment and height of investment was tested. This was done through a Probit regression, since

punishment is a binary variable. The initial model is thus also based on equation (3). This gives us Model 6, in which punishment is the dependent variable, investment height in number of tokens (x_i), is the independent variable, which is and β are the regression coefficients. For Model 7, demographic factors were added to Model 6. The null hypothesis for these models is $\beta_{1,..,n}$=0, which means that there is no relationship between the dependent and the independent variables.

The relationship between investment and round was also tested. Investment per round can be calculated with a normal linear regression, since neither investment nor rounds are a binary variable. The estimated model looks like this:

$$(4)\quad Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n$$

In which investment is the dependent variable, the round in which the investments are made is the independent variable. This gives us Model 8. Model 9 adds the aforementioned demographic variables to Model 8. The null hypothesis for these models is $\beta_{1,..,n}$=0, which means that there is no relationship between the dependent and the independent variables.

4.2.2. Hypotheses

The hypothesis for model 6 is that players who invested more aggressively and less socially, also punished more, since both high investments and punishment can be seen as an aggressive action (Osés-Eraso & Viladrich-Grau, 2007). The hypothesis for Model 7 are the same as the hypotheses for Model 4, assuming that (1) women punish less, since men are more likely to hurt others to advance their interests (Burnham, 2018); (2) older participants punish less, since individuals are better able to regulate their behavioural responses to interpersonal problems as they age (Birditt & Fingerman, 2005); and (3) that people who are at the scouts association for a longer time punish less, since they experience a higher level of social cohesion.

The hypothesis for Model 8 is that investment increased as the game progressed, since players experienced the unfairness of having a low investment compared to a high investment of their partner, and are trying to prevent these differences. Osés-Eraso and Viladrich-Grau (2007) also find this relationship. The hypotheses for Model 9 are in line with those of Model 4 and 7; namely that (1) women invest less, since men are more likely to hurt others to advance their interests, and investment in this game hurt the other indirectly (Burnham, 2018); (2) older participants invest less, since they are conflict-averse and take their environment into account more (Birditt & Fingerman, 2005); and (3) that people who are at the scouts association for a longer time invest less, since they experience a higher level of social cohesion.

4.3. Punishment and difference in scores

4.3.1. Models

After the initial investment decision, the subjects were made aware of their score in the round so far, in comparison to the partner they were currently engaged in the experiment with. Therefore, they learned whether they or their partner had invested more, and thus who had more points at the cost of the other. Only after this, the punishment decision was made. Therefore, it is a strong possibility that the decision to punish or not is based on the score the participant received at this point, especially in relation to their partner. The relationship between the score after the investment decision and the decision to punish was made by creating a binary variable, whether the subject was “behind” or not. A subject was behind if they had less points than the partner they were currently engaged in the experiment with. Since both being behind and punishment are binary variables, for this analysis we will also use a Probit regression model (Model 10), based on equation (3). In Model 10 punishment is the dependent variable, so punishment, being behind is the independent variable so being behind,

and β are the regression coefficients. In Model 11, scarcity was added as a control variable, to see whether scarcity had an influence on this relationship. In Model 12, demographic variables were added to the model as well. The null hypothesis for these models is $\beta_{1,..,n}=0$, which means that there is no relationship between the dependent and the independent variables.

4.3.2. Hypotheses

The hypothesis for Model 10 is that when people were behind, they punished more, since (perceived) inequality is linked to conflict (UN+WB, 2018). The hypothesis for the relationship in Model 11 is that people punish more if they are behind and there is a lower initial common pool resource, since the amount of points to be gained when the initial common pool is also lower, which could strengthen the feeling of unfairness. The hypotheses for the relationships in Model 12 that women perceive less unfairness, and thus are less likely to punish when they're behind, as Pfeifer and Stephan (2018) find that women also perceive differences in their wages more often as fair than unfair. Older people will punish less in general, as well as people who have been a member of the Scouts association longer, in line with the hypotheses made for model 4 and 7.

5. Results and analysis

5.1. Punishment and common pool size

Even though the theoretical model predicts no punishment, since punishment is inefficient in this game, punishment decisions were very present during the experiment. In fact, of the 448 punishment decisions made, punishment was chosen 261 times, while 187 times participants chose not to punish. Figure 1 shows the amount of punishment per condition, showing T1 on the left hand side and T2 on the right hand side. Punishment is indicated with the lighter colour. Figure 2 shows the amount of punishment per experimental round.

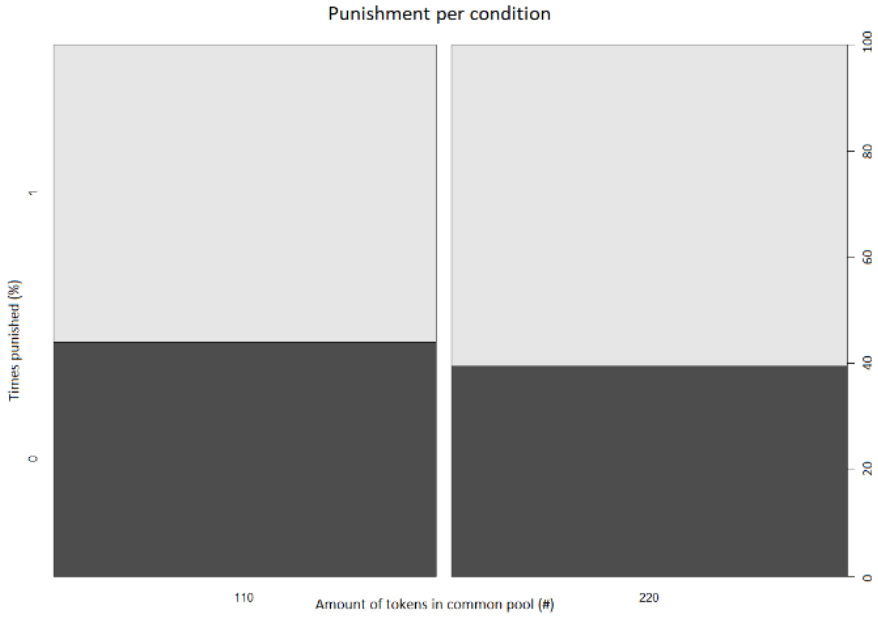

Figure 1 Amount of punishment per experimental condition in percentage

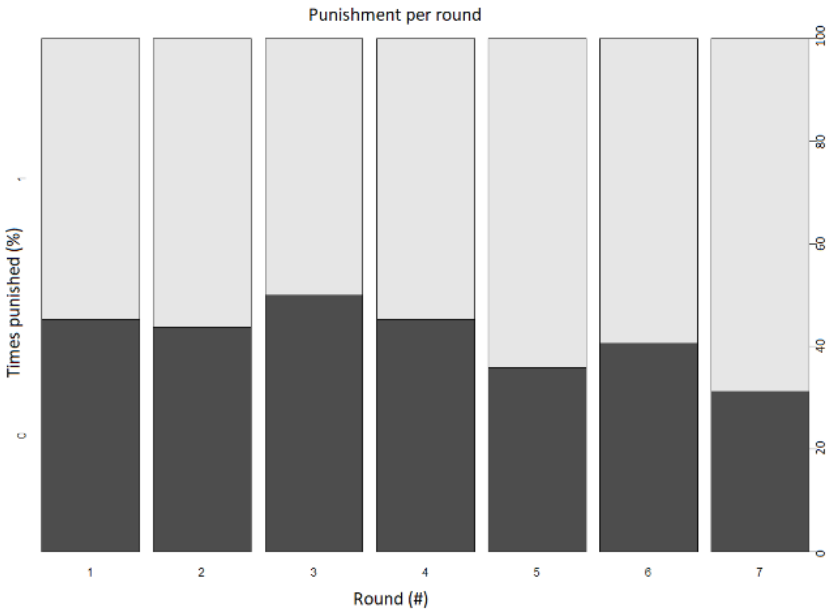

Figure 2 Amount of punishment per round in percentage

The analysis from the data on this subject, as presented in section 2.1, is presented in Table 2. From this table, we can see that there is no statistically significant relationship between common pool size and punishment, with or without adding in the demographic variables, since there is no p<0.1 and therefore the null hypothesis of $\beta_{1,..,n}=0$ cannot be rejected (Table 2). We can even see that the standard error for these relationships is almost as big as the β-coefficient for these relationships, re-confirming that these relationships are not very strong. A relationship between punishment and one of the demographic variables cannot be observed either. From this model, it can also be seen that punishment goes up when the initial pool F_0 goes up. This means that the hypothesis of the argument, namely that when the initial pool is lower, there is more punishment, can be rejected. The hypothesis that the demographic variables influence punishment can also be rejected.

Table 2 The effect of initial common pool resource size, progress in the game and demographic variables on the amount of punishment given

	Dependent variable:			
	Punishment			
	Model 1	Model 2	Model 3	Model 4
Common pool size (F_0)	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Demographic variables				
Age		-0.004		-0.005
		(0.001)		(0.011)
Time at Scouts		0.015		0.016
association		(0.013)		(0.013)
Gender (F)		-0.184		-0.186
		(0.139)		(0.139)
Round			0.059*	0.059**
			(0.030)	(0.030)
Constant	0.030	0.029	-0.215	-0.218
	(0.189)	(0.139)	(0.227)	(0.294)
Observations	448	448	448	448
Log Likelihood	-303.899	-301.076	-301.987	-299.129
Akaike Inf. Crit.	611.799	612.151	609.975	610.258
Note:	*p<0.1; **p<0.05; ***p<0.01			

When looking at the relationship between punishment and round, we can observe a statistically significant relationship. Since p=0.0506 for the relationship between punishment and round, in the model without demographic variables and p=0.0489 for the model with demographic variables, we can reject the null hypothesis of $\beta_{1,..,n}=0$ for both relationships. Since the relationship is positive, the data suggests that the hypothesis that punishment increases when the game goes on can be confirmed. Since the Akaike's information criterion is higher for the models including the demographic variables, it can be said that demographic variables, against the original hypothesis of this paper and further expectations, do have an effect on conflict and strengthen the model.

When we look at Model 5 (annex B), we can see that there are some statistically significant relationships between punishment and the initial common pool resource for 23 out of the 64 participants. This is contrary to results when the responses are averaged out amongst all participants.

However, these were both positive and negative correlations. Therefore, the data suggests that there is no general tendency in the entire population, as the averaged out results also show.

5.2. Punishment and investment

Even though the theoretical model would predict a full investment in project A of 20 tokens at the beginning of each round, the subjects' investments varied greatly, not only between players, but also between rounds. The average investment of tokens per round is seen in Figure 3. The investments per person can be seen in Figure 4, which is, due to its size presented in annex D. These figures combined show that investment varied greatly per person, and there are some variations per round, but these are less clear.

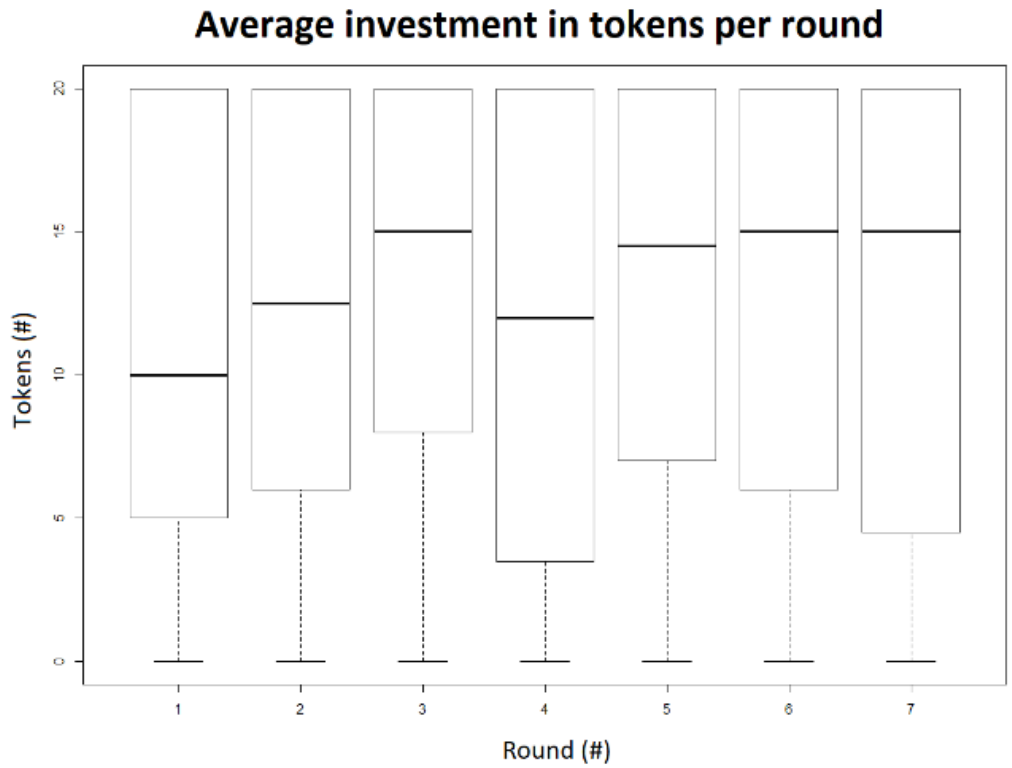

Figure 3 Boxplots of average investment in tokens per round

The results of the Probit-regression as presented in section 2.2 is shown in Table 3:

Table 3 The effect of investment in number of tokens and demographic variables on punishment.

	Dependent variable:	
	Punishment	
	Model 6	Model 7
Investment (x_i)	-0.002	-0.005
	(0.008)	(0.008)
Demographic variables		
Age		-0.006
		(0.012)
Time at Scouts association		0.017
		(0.013)
Gender (F)		-0.187
		(0.139)
Constant	0.232**	0.265
	(0.113)	(0.232)
Observations	448	448
Log Likelihood	-304.360	-301.292
Akaike Inf. Crit.	612.719	612.585
Note:	*p<0.1; **p<0.05; ***p<0.01	

We find that the relationship between investment and punishment is not significant, the p-value of this slope is 0.80446 and therefore the null hypothesis of $\beta_{1,..,n} = 0$ cannot be rejected. Adding control variables such as age, gender and time a subject is a member of the Scouts association did not yield a statistically significant result, which indicates that they also do not influence the relationship. Therefore the hypothesis that on average people who invest more selfishly, punish more can be rejected.

Table 4 The effect of round played and demographic variables on the investment in number of tokens.

	Dependent variable:	
	Investment (x_i)	
	Model 8	Model 9
Round	0.170	0.170
	(0.179)	(0.176)
Demographic variables		
Age		-0.246***
		(0.067)
Time at Scouts association		0.290***
		(0.074)
Gender (F)		-0.088
		(0.820)
Constant	11.509***	13.811***
	(0.801)	(1.367)
Observations	448	448
R^2	0.002	0.048
Adjusted R^2	-0.0002	0.039
Residual Standard Error	7.587 (df=446)	7.436 (df=443)
F statistic	0.902 (df=1; 446)	5.553*** (df=4; 443)
Note:	*p<0.1; **p<0.05; ***p<0.01	

From the analysis presented in Table 4, we can see that, according to this data, there is no statistically significant relationship between investment (x_i) and round played, but there are statistically significant relationships between investment and age, as well as investment and time at the Scouts association. From the analysis we can say that the null hypothesis $\beta_{1,..,n}$ =0 can be rejected for age and time at Scouts association. It is important to observe the direction of the relationship. The data suggests that older people invest less, because of the negative relationship shown in the table above. The hypothesis that older people invest less can thus be confirmed. The hypothesis that people who were at the scouts association longer invest less is rejected, since this relationship is positive with a statistical significance. This means that people who spent more time at the scouts association on average invest more.

5.3. Punishment and difference in scores

In Figure 5, the relationship between being behind and punishment, as explained in section 2.3, is shown. The broader column on the left shows that people are more often not behind than they are behind, since, if there was a draw (both partners had invested equally) neither participant was behind. It can also roughly be seen that there is a greater amount of punishment amongst participants that were behind after the initial investment decision.

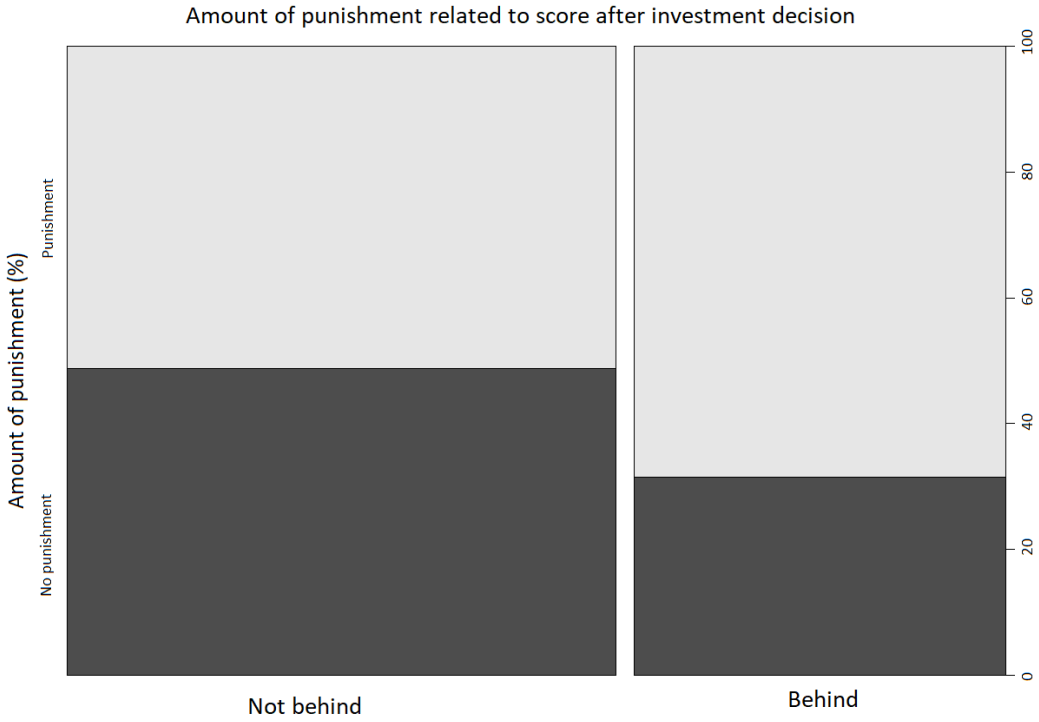

Figure 4 The amount of punishment in percentage related to the score, namely whether a participant was "behind" or not after the investment decision.

The results of Models 10, 11 and 12 are presented in Table 5.

Table 5 The effect of whether a subject was "behind", initial common pool resource size and demographic factors on punishment.

	Dependent variable:		
	Punishment		
	Model 10	Model 11	Model 12
Behind	0.449***	0.467***	0.485***
	(0.124)	(0.125)	(0.001)
Common Pool Resource Size (F_0)		0.002	0.001
		(0.001)	(0.001)
Demographic variables			
Age			-0.007
			(0.012)
Time at Scouts association			0.018
			(0.013)
Gender (F)			-0.193
			(0.141)
Constant	0.033	-0.224	-0.212
	(0.077)	(0.203)	(0.275)
Observations	448	448	448
Log Likelihood	-297.738	-296.797	-293.535
Akaike Inf. Crit.	599.475	599.594	599.069
Note:	*p<0.1; **p<0.05; ***p<0.01		

From this data, we can see that the relationship between punishment and being behind is statistically significant, since the *p*-value is 0.00030. The null hypothesis of $\beta_{1,..,n} = 0$ can thus be rejected. We can observe a positive relationship. The data thus suggests that hypothesis that people punish more when they are behind can thus be confirmed. Other factors, such as the initial common pool resource size or demographic variables, decrease the p-value of the relationship between being behind and punishment. The *p*-value for model 11 is 0.00017 and for model 12 0.00013. The Akaike's information criterion for the model with demographic variables is lower, which means that this model does not have a better fit. Therefore, the data suggests that the relationship between being behind and punishment does not rely on demographic variables.

6. Discussion

"Resources such as land, water, and extractives are traditional sources of friction. The effects of climate change, population growth, and urbanization are intensifying these risks. Disputes over resources have spilled over into violent conflict and instability across the world. Improving the sharing of resources and benefits derived from them as well as strengthening local conflict resolution mechanisms are important areas of focus." – UN/WB "Pathways for Peace" report, p. xi.

In this discussion, the findings of this study will be placed in the current body of research on the relationship on the link between natural resource degradation and violent conflict, as presented above. As stated by many studies, this relationship is a complex one, but there is a link between the current patterns of increasing ecosystem degradation and increasing conflicts (Brottem, 2016; Van Baalen & Mobjörk, 2017; Seter, 2016). This study aims to shed a light on the aspects of human behaviour around resource conflicts in a controlled environment. These can then hopefully be extrapolated to field cases.

6.1. Conflict under scarcity

Some studies find a positive correlation between experimentally induced scarcity and cooperation (e.g, Rutte et al., 1987; Osés-Eraso et al., 2008), while others come to the opposite conclusion (e.g. Blanco et al., 2012; Varghese et al., 2013). For example, whilst Prediger et al. (2013) find that punishment is higher in an abundant situation, Lecoutere et al. (2010) see that conflictive behaviour increases when scarcity is present. In this study, the results show no definite correlation between the amount punished and scarcity. This could be because of the fact that the studies mentioned above offered more context, for example in crop fields or river-water appropriation and used participants that faced these contexts in their day to day life as well (Prediger et al., 2013 & Lecoutere et al., 2010). Whilst this study presented the game was abstract and participants' livelihood did not depend upon a common pool resource in a day-to-day fashion. This means that payoffs are different. Engaging in conflict could, for example have a slight benefit, because it could lead to more control over resources, or an even greater loss, since lives are actually on the line.

The fact that this abstraction yields no significant results, whilst studies in context do, is consistent with the current line of thinking in linking natural resource degradation and (violent) conflict. If punishment is seen as conflictive behaviour, this study does not show any links between scarcity and conflictive behaviour. Therefore, one could say, based on these results that there is no robust direct link between violent conflict and scarcity. This could be placed in the context of the literature. The link between violent conflict and the effects of for example climate change is found in recent studies (Burke et al., 2009; Gizelis & Wooden, 2010; Fjelde & von Uexkull, 2012; O'Loughlin et al., 2012). These studies, however, link the presence of environmental degradation to the presence of violent conflict, and do not examine the mechanisms. When they do speak of mechanisms, they indicate that these mechanisms are not a direct link (Brottem, 2016; Fröhlich & Brzoska, 2015; Linke et al., 2015; Sterzel et al., 2014). Additionally, studies that solely focus on the mechanisms between ecosystem degradation and conflict also state a relationship that is heavily influenced by context (Benjaminsen & Ba, 2009; Benjaminsen & Ba, 2018; Van Leeuwen & Van Der Haar, 2016; Benjaminsen et al., 2012). This means that the created controlled environment in which the relationship is relatively isolated as presented in this thesis, strengthens the research that has been done related to the complexity of the relationship, more variables are needed to find a robust link between resource scarcity and conflict.

The lack of context of this study thus helps us understand the situation, since it does not only speculate about the linearity, but also effectively rules out a linear link. However, perversely, due to this lack of context, behaviour of people could be "laxer" than in a real-life situation, since they are not faced with

consequences and do not have a relatable image in mind which changes with the choices they make. Castillo et al. (2011), for example, explain how the context determines cooperation levels and that decisions were made as a reflection of participants' own contexts. Since there was no context in this experiment, and the participants had no direct, personal value attached to the common pool resource, it could be that these results are hard to extrapolate. Also, the concept of time is not taken into account. Since the opponent subjects play with is randomized and anonymous, an anger towards another player cannot be built over time. This could, however, play a role in real-life situations.

This reservation is only strengthened by the statistically significant relationship between punishment and round. As the game continued, subjects punished more often. This is in with the findings of Osés-Eraso and Viladrich-Grau (2007) and Melo and Piaggio (2012) Interestingly, both studies use a sequence of one-shot games, as was done in this research. An increase in conflictive behaviour is thus linked to the sequence of games, whether or not the opponent remains the same or not in all three cases.

6.2. Age, time spent at the Scouts association and investment

Another interesting find of this study is the negative correlation between age and investment and the positive correlation between time at the scouts association and investment. This is especially interesting because older participants are likely to have spent a longer time at the Scouts association. The correlation between age and investment can be explained with the rationale behind the hypothesis, namely that older people are more likely to avoid conflict and "pick their battles" (Birditt & Fingerman, 2005). Since they knew that a higher investment could probably lead to a conflict, since this diminished the common pool more, they were probably more likely to take the more social route, trusting their partners would as well. That time spent at the Scouts association correlates with a higher investment is harder to explain. This could be due to the fact that people who spent more time at the Scouts association had a closer bond with all players and were thus less likely to be afraid of hurting this bond by investing more.

6.3. Conflict under inequality

Whilst the experiment was conducted, several subjects indicated with short quips in-between their investment and punishment decisions, that they were punishing because they felt like their partner had acted unfairly, for example "STRAF DIE BITCH" (punish that bitch), "Godverdomme, zeker wil ik straffen" (God damnit, I certainly want to punish) or "hahaha ok my partner speelt het vies" (hahaha ok my partner is playing dirty). Based on this, the correlation between being behind after the investment decision and punishment was investigated. This did yield quite strong and statistically significant results. The results showed that when a participant was behind after the first round, they were more likely to punish their partner than when they were not. This can be put in the context of literature on conflict under inequality between members of a group.

The link between inequality and violence is prevalent in literature on relationships between natural resources, livelihoods and conflict. For example, the recent UN/WB (2018) report, states that "many of today's violent conflicts relate to group-based grievances arising from inequality, exclusion, and feelings of injustice" (p.109), but it also explores that these ideas have been present since ancient Greek times. Links to natural resources and inequality have been made as well and there are several papers which include the mechanism of inequality in conflict over natural resources. Dell'Angelo et al. (2016) explain how as hydroclimatic change, population growth and water inequality challenge the community's ability to manage their water resources, and both the resource and communities suffer. Chang and Peisakhin (2018) and Hugh-Jones and Leroch (2017) explain how revenge occurs in groups when there is a perceived inequality, and in these cases conflict resolution also often fails. This conflict

over inequality becomes even more present if leaders can frame this narrative of inequality as unfair, one example given is how leaders in Indonesia transformed unfocused resentments about natural resources into grievances that would mandate violence (UN/WB, 2018; Aspinall, 2007). Must (2016) also describes that in the nexus between conflict and natural resources a feeling of injustice particularly motivates participants of riots over natural resources, more so than personal material gain.

Our research does fit well in the frame of Must (2016), since punishment in our experiment did not affect personal gain for participants, but there was punishment present anyway. This means that the motivation of personal gain does not hold within our experiment, whilst this is articulated in other papers (DeJuan, 2015; Van Baalen & Mobjörk, 2017).

6.4. Overall limitations of the study

Of course, this study also has its limitations. A clear limitation is the extrapolation of punishment as conflict. Even though this has been done in studies before, it could be that the participants did not perceive punishment as conflictive behaviour, but just as a part of the game. The same counts for scarcity. Perhaps the amount of tokens in the common pool was not something participants based their initial investment decisions on. In future research, it would be good to ask participants whether or not they perceived the conditions of the game as intended after the fact, since adding this beforehand, for example, stating that they should especially mind the amount of points in the shared common pool, could steer the results.

Another limitation of this study, specifically regarding the inequality outcome, is that the experiment was not specifically designed to measure the influence of (perceived) inequality on the decision to punish or not. Since perceived inequality was not directly measured, there was no question asked whether or not the participants found the score unfair or not. For example, it cannot be said for certain that perceived inequality was the reason that subjects chose to punish when they were behind. This also means that the two different conditions participants were put in can be seen as extra influencing variables, creating noise in the result, even if they were controlled for. Another limitation is the quite limited sample size of 64 participants. Because of this, it is quite hard to control for variables such as age, gender or time spent at the Scouts association, since the number of people in these categories are even more limited than the number of people in the study overall. This especially limits the results on time at the scouts association and age.

7. Conclusion and Recommendations

Does scarcity increase conflict around Common Pool Resources? According to the findings of this study, scarcity alone, without context, does not increase conflict around Common Pool Resources. It is found that (perceived) inequality, or having less than your partner, does increase conflictive behaviour around Common Pool Resources. In addition to this, the current trend in the literature, namely that the link between natural resource degradation and violent conflict is non-linear and very complex, as well as that conflicts always have to be placed in their political, social and environmental context in order to be understood is confirmed. This study is, paradoxically, also limited by its lack of context, since this produces findings that are more difficult to extrapolate to real-life situations.

Overall, this study contributes to a recently new body of knowledge. It strengthens the current recommendation to policy makers that when acting on conflicts, natural resources could play a role, especially in the frame of equality. Changes in natural resource availability could be taken into account, but that the social and political context should not be forgotten. Environment more of a threat-multiplier than a cause of conflict. Inequality, for example, could have a greater influence on conflict. Based on these findings it is therefore recommended to keep viewing conflict in a broad lens, and act on a case-by-case basis. For future research more in-depth and perhaps experimental research into inequality, natural resources and conflict is recommended.

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Annex A – Experiment instructions

Welkom bij mijn experiment

Tijdens de uitleg van het experiment is het welkom om met elkaar te praten. Mochten jullie vragen hebben, kan je natuurlijk altijd bij mij terecht. Tijdens de uitvoering van het experiment mag je niet met elkaar het experiment bespreken, dit kan namelijk de resultaten beïnvloeden.

Mijn experiment onderzoekt hoe mensen beslissingen maken in een economische omgeving. In deze instructies vind je meer informatie over de beslissingen die je kunt nemen en de gevolgen van deze beslissingen.

Afhankelijk van je beslissingen kun je per ronde punten winnen. Voor iedereen wordt één van zijn rondes geselecteerd om kans te maken op de prijs. Per punt wat je in de geselecteerde ronde hebt verdiend, krijg je één lot voor het winnen van de prijs. Iedere ronde maak je dus opnieuw kans om hoog te scoren. Des te meer punten je wint, des te groter dus de kans dat je wint!

Het experiment

Na de uitleg van vandaag, start het experiment over WhatsApp aanstaande vrijdag. Het experiment duurt een week. Je speelt iedere dag van deze week een ronde. In één ronde stuur je mijn twee WhatsApp berichten. Dit betekent dat je er maximaal 5 minuten per dag aan kwijt bent.

In iedere ronde moet je twee beslissingen nemen, één over je investeringen en één over of je wilt straffen of niet. Je wordt gekoppeld aan 1 andere deelnemer en vormt een **groep van 2.** Je weet niet aan wie je gekoppeld bent. Na iedere ronde verandert de persoon waaraan je gekoppeld wordt. De hoeveelheid punten die je verdient is afhankelijk van jouw beslissingen en de beslissingen van de het andere lid van je groep.

De investeringsbeslissing

Aan het begin van iedere ronde krijgen jij en je partner een gezamenlijke pot. In deze pot kunnen **220** of **110** punten zijn, dit zal toevallig zijn en per ronde verschillen. De punten in de gezamenlijk pot worden aan het einde van de investeringsbeslissingen, eerlijk tussen jou en je partner gedeeld. Jij kunt meer punten krijgen door ook fiches in een privé project te investeren. Dit heeft echter invloed op de hoeveelheid punten in de gezamenlijk pot.

Aan het begin van iedere ronde kun je maximaal 20 fiches in een privé project investeren. Voor ieder fiche dat je investeert, verdien je **2** punten. Voor ieder fiche dat je investeert, zullen echter **3** punten uit het gezamenlijke potje van jou en jouw partner verdwijnen.

Inkomen uit het Privé project

Ieder geïnvesteerd fiche = 2 extra punten voor jou

Inkomen uit de gezamenlijk pot

In het begin zijn 110 of 220 punten in de pot

Ieder geïnvesteerd fiche = 3 punten verdwijnen uit de gezamenlijke pot

De gezamenlijke pot zal tussen jou en jouw partner verdeeld worden.

Praktisch gezien verloopt het investeringsgedeelte dus zo:

- Je krijgt van mij een WhatsApp dat je gekoppeld bent aan een partner, met daarbij hoeveel punten er in jullie gezamenlijke pot zitten.
- Jij WhatsAppt naar mij hoeveel fiches je wilt investeren

- Je krijgt van mij een WhatsApp terug met hoe je partner geïnvesteerd heeft, met daarbij meteen hoeveel punten jij en jouw partner verdiend hebben.

[Hier volgt een live voorbeeld]

De beslissing om te straffen

In iedere ronde, na de investeringsbeslissing, word je gevraagd of je je groepspartner wilt straffen. Het straffen van een groepspartner kost jou **5** punten, maar zorgt ervoor dat je groepspartner **20** punten verliest. Het kan zo zijn dat één van jullie kiest om te straffen, geen van jullie of jullie allebei. Je weet pas of je groepspartner gekozen heeft voor straffen nadat jullie allebei je beslissing doorgegeven hebben.

Praktisch gezien verloopt het strafgedeelte dus zo:

- Na het horen van het aantal punten dat je over hebt, krijg je van mij een WhatsApp met de vraag of je je groepspartner wilt straffen.
- Jij stuurt mij een bericht met “straffen” of “niet straffen”, je groepspartner ook.
- Je krijgt van mij een bericht terug met of je groepspartner je heeft gestraft of niet en met hoeveel punten je over hebt aan het einde van de ronde.

[Hier volgt een live voorbeeld]

De volgende ronde

Na één investeringsbeslissing en één strafbeslissing wordt je gekoppeld aan een **nieuwe groepspartner**, jullie krijgen een nieuwe gedeelde hoeveelheid punten en de punten die je verkregen hebt uit de vorige ronde worden opgeslagen. Deze punten kun je niet meer investeren. **Iedere ronde is onafhankelijk van de vorige.**

Korte vragenlijst

1. Voornaam

   _____

2. Geslacht
   - Man
   - Vrouw
   - Anders

3. Leeftijd

   _____

4. Aantal jaren bij de scouting

   _____

5. Functie bij de scouting (kruis aan wat toepasbaar is)
   - Lid
   - Leiding
   - Teamleider leidingteam
   - Bestuur

- Anders, namelijk:_____

Om te controleren of jullie mijn uitleg begrijpen en de resultaten dus goed zijn, volgen hier een paar vragen. Deze hebben verder geen invloed op het aantal punten wat je verdient. Ga er hiervoor vanuit dat er 150 punten in de gezamenlijke pot zitten.

1. Jij en je partner investeren geen van beiden in jullie privéproject
    - De hoeveelheid punten in de pot verandert met +__en/of -__
    - Jij verdient __ punten vanuit je privéproject
    - Jij verdient __ punten vanuit de gezamenlijke pot

2. Jij en je partner investeren allebei 20 fiches in jullie privéproject
    - De hoeveelheid punten in de pot verandert met +__en/of -__
    - Jij verdient __ punten vanuit je privéproject
    - Jij verdient __ punten vanuit de gezamenlijke pot

3. Jij investeert 5 fiches in jouw privéproject, je partner investeert 10 fiches in zijn privéproject.
    - De hoeveelheid punten in de pot verandert met +__en/of -__
    - Jij verdient __ punten vanuit je privéproject
    - Jij verdient __ punten vanuit de gezamenlijke pot

4. Jij straft en je partner straft niet
    - Jouw hoeveelheid punten verandert met +__en/of -__
    - De hoeveelheid punten van je partner verandert met +__en/of -__

5. Jij en je partner straffen allebei
    - Jouw hoeveelheid punten verandert met +__en/of -__
    - De hoeveelheid punten van je partner verandert met +__en/of -__

6. Jullie straffen geen van beiden
    - Jouw hoeveelheid punten verandert met +__en/of -__
    - De hoeveelheid punten van je partner verandert met + __en/of -__

Annex B – WhatsApp Messages sent to participants

1. **Begin experiment**

   “Hallo, je bent nu gekoppeld aan een nieuwe partner. Jullie hebben een gezamenlijke pot van X punten. Hoeveel wil je investeren in je privéproject? (Maximaal 20 punten)

2. **Na investeringsronde**

   “Jij en je partner hebben nu allebei geïnvesteerd. Jij hebt nu X punten, je partner heeft Y punten. Wil je je partner straffen?”

3. **Na straffen**

   “Jij hebt wel/niet gestraft, je partner heeft wel/niet gestraft. Jij hebt nu X punten, je partner heeft Y punten. Dit is het einde van de ronde. Je wordt zo gekoppeld aan je volgende partner.”

Annex C – Table Results of Model 5

Table: The relationship between Common Pool Resource Size and Punishment per participant.

	Dependent variable:
	Straf
F0	0.001
	(0.001)
PAnnemieke	-4.500
	(367.836)
PAnniek	1.601**
	(0.778)
PAnthony	1.605**
	(0.778)
PBas	1.636**
	(0.774)
PBert	0.876
	(0.758)
PCorine	0.887
	(0.758)
PDaniel	0.877
	(0.758)
PDirk	0.002
	(0.830)
PElias	0.877
	(0.758)
PEnzo	-4.541
	(367.774)
PErin	0.460
	(0.781)
PGuus	0.477
	(0.777)
PGwendolyn	6.615
	(367.765)
PHans	1.237
	(0.758)
PHugo	2.104**
	(0.839)
PIne	2.110**
	(0.832)
PIsa	0.482
	(0.776)
PIvo	2.119**
	(0.831)
PJan	0.879
	(0.758)
PJantie	1.216
	(0.762)
PJennes	6.626
	(367.732)
PJob	1.207

	(0.765)
PJohan	0.887
	(0.758)
PJoost	6.636
	(367.736)
PKim	0.888
	(0.758)
PKim W	6.636
	(367.736)
PLars B	2.130**
	(0.832)
PLars F	6.626
	(367.732)
PLaurens	2.121**
	(0.834)
PLuc	0.876
	(0.758)
PMaaike	2.127**
	(0.830)
PMaartje	2.130**
	(0.832)
PMarloes	1.217
	(0.762)
PMatt	1.227
	(0.760)
PMees	1.627**
	(0.775)
PMerel	-0.023
	(0.834)
PMilou	0.486
	(0.775)
PMiriam	0.848
	(0.765)
PMyrthe	-4.522
	(367.732)
PNadine	1.247*
	(0.758)
PNoud	1.248*
	(0.758)
PPim	0.869
	(0.760)
PRemko	2.130**
	(0.832)
PRemon	-0.026
	(0.834)
PRens	2.110**
	(0.832)
PRick	0.857
	(0.762)
PRick W	2.130**
	(0.832)

PRoy	2.085**
	(0.840)
PRuben	0.867
	(0.760)
PRuud	6.593
	(367.948)
PSebastian	0.490
	(0.775)
PSjoerd	2.130**
	(0.832)
PSophie	2.138**
	(0.831)
PStefan	2.130**
	(0.832)
PThijs	1.623**
	(0.775)
PTiki	0.876
	(0.758)
PTim	1.636**
	(0.774)
PTom	0.503
	(0.774)
PVera	1.609**
	(0.776)
PWessel	2.138**
	(0.831)
PWouter R	1.605**
	(0.778)
PWouter W	0.867
	(0.760)
PYacine	0.869
	(0.760)
Constant	-1.157*
	(0.613)
Observations	448
Log Likelihood	-218.234
Akaike Inf. Crit.	566.468

Note: *p<0.1; **p<0.05; ***p<0.01

Annex D – Boxplots of average investment in tokens per participant