

Article

## Beyond Awareness and Self-Governance: Approaching Kavango Timber Users' Real-Life Choices

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**Abstract:** Targeted illegal harvesting of hardwood in the woodland of Namibia's Kavango region threatens forest stands. In a transforming setting, where wood is increasingly traded through value chains on a globalized market, local harvesters have complex incentives but also a crucially important position. Sustainability largely depends on their choices. Such choices are being influenced by awareness campaigns and decentralized forest management, which are being lauded and supported. Having produced an ethnographic awareness film (AF) on the problem of logging and the opportunities for community forests (CF) to reduce extractions while raising community income, we approach the influence of the instruments of film and community forests on forest-users' real life choices with an economic public goods game. We compare villages that have experienced influences to a differing degree. We find more extraction in AF and no effect for CF at village level. Instead, the extractive impact of certain experimental and free riding personality types, whose strategies remain stable across the experiment, is equally distributed among villages. We discuss methodological implications and the fact that in a situation of ecological and socio-economic challenges certain players use game and real life opportunities to decouple individual choice from problem awareness and the social control-setting.

**Keywords:** Southern Africa; illegal logging; deforestation; awareness film; community forests; public goods experiment; individual player strategies; livelihoods

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## 1. Introduction

New Era, a leading Namibia newspaper, recently called the ongoing process of illegal harvesting of timber in the northeast of Namibia, especially the forest rich Kavango region, a “plunder of timber” [1]. In fact, the targeted cutting of several hardwood species poses an ongoing threat to forest stands [2,3]. Over the last decades, Kavango timber has become a valuable resource for the national and South African woodworking industry. Trading from the Kavango, and increasingly southeast Angola, towards Windhoek, the national capital and further on is executed through chains of value-adding. On the ground, logging of targeted timber species has become an extra source of fast cash for local landusers. Most of the harvesters live in rural subsistence without significant cash income and feel strongly incited to earn cash from commodifying natural resources to complement their rural subsistence based livelihoods. While the harvesting and intermediate trading is mainly organized by small scale entrepreneurs from the urban setting with sufficient capital for transport, food and equipment the actual harvesting is to a large part being executed by small subcontracted teams of local harvesters manually by using pit-saws [4]. This practice is highly ineffective leaving a large part of the tree unutilized behind. Awareness for the ecological as well as economic value of forest resources has been found to be lacking [5]. Institutionally the setup is also not prone to protection as it is contested. Kavango forests are mainly “communal land”, that is property vested in the government of Namibia, factually governed by competing statutory and traditional authorities [6,7]. That means that landscape and resources are increasingly being perceived as less personally owned but rather property of a strange and far away state [8,9]. Statutory control of access and enforcement of laws in a territory larger than Switzerland is hampered by underfunding and understaffing and is executed by only a dozen sufficiently trained foresters [7].

This rough sketch of a Namibian case is exemplary for a trend that happens all across Africa [10–12] which is also illustrative of a broader problem of human sustainability interfacing with the consequences of economic action through the voluntary trade of commodified resources [13,14]. Since 1990 Namibia has lost over 12% of its forest cover and the rate of deforestation has increased in recent years; between 2000 and 2005, deforestation occurred at a rate of 0.93% per year [4]. Timber harvesting is happening in a setting of transformation where wood is increasingly becoming a commodity in a globalized market, insufficiently protected by contested institutional setups, and traded through value chains [15], by actors with multiple interests involved in highly dynamic social settings. In this situation, local harvesters as the factual wardens of their forests, and at the same time the effective harvesters, have a crucially important position. They are often trading-off the collective goals of stock protection against individual benefits. Sustainability largely depends on their choices, which in many cases are not being fully informed by the externalities of harvesting and are biased by the cooperation dilemma that other selfish harvesters, called free riders, enjoy group benefits at the cost of others. An ideal setup for limiting the detrimental effects of harvesting would be a combination of conscious anthropogenic extractions, often labeled as ethical consumerism or conditional cooperation [16], as well as sufficient monitoring and control to enforce pro-social behavior and limiting exploitative free riding. Such an approach is a complex social challenge, which requires a sufficient understanding of the real life influences on people’s choices—entailing local desires for cash income and a consumerist lifestyle, as much as political, legal and institutional aspects.

In fact, in current Kavango real life, the forest user's choices often happen between the limiting influences of *awareness or knowledge creation* and *decentralized forest management* on one side and the incentives of cash and market-based value chains on another. The first influence are discourses sparked by local, statutory and civil-society agents, especially awareness raising and knowledge transfer campaigns and media discourses executing the social and moral pressure of sustaining scarce public goods for the future [17]. These attempts have to be perceived within an equally dominant discourse on development, the widespread and westernized paradigm of linear, societal improvement through increases in wealth, social security, education, infrastructure, democracy, market-economy and the like [18]. Typical products are forest related brochures, posters, television and radio broadcasts, public meetings and film.

Secondly influential are the institutional and legal pressures of protecting and enforcing pro-social and collective property protection. The institutional setup involves traditional and statutory authorities and has especially focused on an institution called "community forests" (CF) as a means of raising local users' self-governance and ownership in the absence of efficient statutory control regimes. With the concept of CF government agencies and NGO attempts to create incentives for communities to protect resources by devolving user rights and income potential for communities through equal use, reinvestment and distribution of forest revenues [19,20]. Communities can enter into a written agreement with the Namibian Minister of Agriculture, Water and Forestry (MAWF). The agreement then confers the rights "to manage and use forest produce and other natural resources of the forest, to graze animals and to authorize others to exercise those rights and to collect and retain fees and impose conditions for the use of the forest produce or natural resources" [19]. CF can sell permits, collect harvesting fees and thus generate some collective income. However, they are a complex institutional mechanism that requires ownership and understanding by local communities to not remain yet another externally implemented idea. Based on experiences with CF, Namibia plans to strongly expand them [21].

Despite the fact that empowerment through user awareness and (self-) control through the devolvement of user rights seem to be very necessary steps to mitigate cooperation dilemmas, sustain timber resources and the equitable sharing of values it is unclear to what extent they impact upon users' decisions in real life with imperfect monitoring and law enforcement and strong external incentives to free-ride and focus on personal gains at cost of common sustainability. In this article, we aim to better understand Kavango timber users' real life choices and decisions as influenced by these dimensions. We ask: How effective are such approaches in shaping users choices?

To do so we report of a cascade of interdisciplinary methodological steps that we undertook. Grounding on several years of anthropological fieldwork since 2003 we have gained a detailed understanding of the resource use framework especially the situation of community forests [5,22] and we have produced an ethnographic awareness-raising film (AF) that aims to inform the local user population about problems, consequences and alternative strategies related to resource overuse as well as deforestation through illegal harvesting [23]. This film named "Wiza Wetu" (Our forest) of 52 min was produced in the local vernacular *Rukwangali* with English subtitles. A local narrator and a very clear narrative structure are used to illustrate the functioning of the illegal harvesting along the spatial nodes of the value chain. The film addresses the collective nature of property rights, legal procedures, and externalities such as the considerable loss of value in the Kavango. It then outlines and depicts the

functioning and the additional communal benefits of the concept of community forests and appeals to local landusers and resource owners to execute their rights, harvest sustainably and benefit and market efficiently. It was shown twice on Namibian national television in 2008 and was being screened by mobile technology in 30 Kavango villages during 2008 and 2009. Public discussions after the screenings were observed as very lively, lasting for hours, and circling around potential ways of avoiding overharvesting and increasing community income. Despite the fact that such screenings constitute highly welcomed and memorable social events, it remains unclear what the real-life impact of them on behavior is. Interviews run the danger of response effects, especially deference and acquiescence effects [24].

Having experienced the success of the film about the concept of equally widely lauded community forests, we hypothesized that AF and CF, a combination of increased knowledge-based awareness and institutional setup of better (self-) control should incite behavior more protective of resources causing less extractions. To test our hypothesis, in 2008 we used a framed economic field experiment. We use the term “framed” because we refer to timber harvesting throughout the experiment. The idea of field experiments is to incentivize participants’ decisions with money in order to circumvent the hypothetical bias inherent in talk or questionnaires (*i.e.*, participants need to forgo potential earning in order to be cooperative) [25]. The experiment offers unambiguous incentive structures to control for the different perception people might have with regard to the benefits and costs of co-operation in collective action for timber extraction. The experiment induces a similar payoff function to all our subjects. In the payoff function it is specified that harvesting timber brings private benefits but less than could be earned from harvesting collectively. However, assuming rational self-interested players, participants have an incentive to increase their private timber because they can always earn more if they ‘free-ride’ while other players cooperate. Given that person A will extract all for herself it is person’s B best response to do so as well (Nash equilibrium). At the end both could have been better off by cooperating and not extracting privately (social optimum). It has been found in previous literature that people in CPR experiments do neither play Nash equilibrium nor social optimum [26].

Experimental economics thus offers a test bed for individual harvest decisions under conditions of a potential material gain. The study from Rustagi *et al.* [16] or Fehr and Leibbrandt [27] showed that these experiments have high external validity and match real world behavior. We attempted to closely adapt the experimental decision situation, extractions from a common forest resource, to decision situations the Kavango participants already know from their real life. Experiment participants then played this public goods game in groups for 20 rounds of which the first 10 rounds were especially targeting the above questions.

Two additional treatments were introduced after the first 10 rounds. These were either an external punishment rule (EPR) with imperfect enforcement or an internal punishment rule (IPR) where group members could punish each other at own costs. These treatments were thought to resemble the external monitoring and enforcement capacities through statutory and traditional authorities in case of the EPR and the social control mechanisms within communities in case of the IPR. Half of the village sample population would play the EPR while the other half would play IPR. They were added to investigate the different reaction towards different forms of control and mirror real life experiences of either control by the Namibian Directorate of Forestry vs. community self-control, that is the social sanctioning mechanisms of other-concerned forest users. However, since these treatments address a different level

and set of questions about the effectiveness of the type of control we will treat them in detail elsewhere. We formulated the following hypotheses for game results:

- **Extractions** will neither be at the selfish prediction nor at the cooperative social optimum. A substantial amount will be left on the public account. Over time, extractions will increase.
- **Extractions** will be lower in communities where the awareness film has been screened than in communities where it has not been screened (moral message).
- **Extractions** will be lower in communities where players are acquainted with the rules, functioning and benefits of community forestry than in communities where they are not (learned rules).
- Both effects will add upon each other. Consequently, the village where the film has been screened and the community forest rules are known will show the lowest extraction rates.

Experiments happened in four Kavango villages conducted with people who were exposed to AF and CF strategies with varying degree (see design below). Although we are aware that the forest resembles a common-pool resource with rivalry in use and non-excludability our design resembles a public good game since we only model the rivalry with a threshold value. We present results from the experiment that indicate that especially the film's awareness message was ineffective and even counterproductive as it might have changed people's beliefs—now assuming that most people do illegal harvesting. We also discuss the implications of a slight reduction of harvesting behavior through the CF under game conditions. Using additional ethnographic knowledge and results from a reassessment with a survey and qualitative ethnographic methods which were taken in 2009 we will additionally outline the finding that certain player-types follow rather stable strategies and are well distributed across villages.

In sum, this series of steps involves the fruitful cross-fertilization between economic and anthropological methods and findings. We use this complementary cascade of steps and data to approach a broader picture of the challenges of understanding timber harvesters' choices. We will especially discuss methodological and theoretical challenges that have not been tackled so far and ask: What other impacts such as global value chain incentives and processes are at work and how can we approach them scientifically/methodologically? What is the struggle between the social structure (governance, internalized discourses) and individual agency (self-interested behavior *vs.* awareness) under conditions of rapid social and economic transformations?

## 2. The Experiment

### 2.1. Backgrounds, Sample Choice and Composition

The people in the central Kavango region all live within a similar dry-forest savannah ecosystem. Our whole sample consisted of 120 people from four villages of the central Kavango region. Village sizes in the area differ between 100 and 300 persons. They are situated within a vicinity of 45 km and were chosen because they are (1) equally affected by the problem of illegal harvesting which happens in a targeted and selective manner all across Kavango; (2) situated rather close to the road a major axis of marketing; and (3) known through ethnographic encounters [5]. Three villages are situated along the road that connects Rundu with the south of the country. One village No. 2 is situated 3 km

away from that road in the hinterland. In each village, 30 adult people participated in 6 sessions of 5 players. Players were informed on a short notice beforehand that the experiment would take place and all eligible households from the village were invited to send players who would be able to understand the rules and participate in the game. On the day of the game, before recruiting actual players, it was made sure that all sending households would be represented. Players then were recruited randomly and were assigned to groups randomly as well. After that, players were instructed about the logic and procedure of the game in detail, including example calculations and a minimum of two test rounds. All experiment instructions were presented orally in *Rukwangali* accordingly. The instructions included examples of possible actions and outcomes and several test rounds were played before the actual game started. For example, the protocol stated "... if you as a community acquire the use-rights then you are permitted to sell permits and harvest and sell these resources for money to gain an income for you and the community... In general you can earn more forest resources if you work together with your community". The facilitators were the same for all sessions. A post-game questionnaire survey on basic demographic information and the understanding of the experimental design and decision tasks was conducted. An English version of the game instructions and decision card can be found in the Appendix.

The overall sample was composed by 61 women and 59 men. The average age in the whole sample was 31 years (Std. Dev. 11.67) with the youngest players were 19 years old and the oldest players were 71 years of age. Low average age data mirror the pyramidal age distribution of the very young Kavango society. The majority of participants stated that they were occupied in rural subsistence farming and 48% of participants stated to have some sort of regular income (Std. Dev. 49.9). Households comprise of a mean of 8.8 people (Std. Dev. 5.20). While the largest rural household has to support 30 members a major fraction lies below the average value. On average people had lived in the villages for a mean of 12.18 years (Std. Dev. 8.09). In general, villages are very heterogeneous in regard to ethnic and national provenance. The ethnic affiliation in the sample differed as well, mirroring the mixed ethnic composition of the villages. The largest fraction in the sample were people who consider themselves a Kwangali with 38% (Std. Dev. 48.6), followed by two groups whose members migrated to the region during recent decades as a consequence of the war in neighboring Angola, namely Nyemba 23% (Std. Dev. 42.31), and Tjokwe 13.3% (Std. Dev. 34.0). People within the sample had an average school education of 7.1 years (Std. Dev. 4.28), with few rather young male roadside players having completed grade 12 and a larger fraction of especially older hinterland players being illiterate. Separate calculation for women and men showed that women had on average 7.57 years (Std. Dev. 3.59) of school education and men 6.94 years (Std. Dev. 4.61).

## 2.2. Design

The four villages have been exposed to the two main protection-strategies in four different ways (Table 1).

**Table 1.** Study design incorporating four villages in the central Kavango.

	Community Forest	No Community Forest
Awareness Film	Village 1	Village 2
No Awareness Film	Village 3	Village 4

Village one and three were situated within the boundaries of two distinct community forests. During the establishment phase of the community forests through the Department of Forestry in Rundu, which was strongly supported by the German Development Service (DED) in its Community Forestry in North-East Namibia (CFNEN) project [28], communities had elected a management body, had defined boundaries, had received a forest office, and members of the management body had received considerable training regarding the establishment of management plans, forest stock-keeping, accounting *etc.* It can be taken for granted that also villagers who have not been directly involved have debated this novelty and have come in close encounter with the ideas surrounding the equal benefit sharing through sales of common resources and devolved resource protection surrounding the CF. Villages 2 and 4 were not part of community forests. Villages one and two had been exposed to the awareness film two weeks before the experiment and ahead of the experiment it was made sure that only people would participate in the experiment which had actually seen the public screening. In villages 3 and 4 it was the contrary case, people had not seen the film and it was made sure that only people participated who had never seen the film.

We used a non-standard non-linear public-goods-extraction experiment with  $n = 5$  players and  $m = 20$  rounds. In each village six sessions were played, normally in classrooms of the school or the community forestry office. Subjects were aware of the identity of the other group members but game decisions were made in private, individually, without communication, and were kept largely confidential even after the game ended. The game was framed as a task to extract timber and other forest resources (FR) from a commonly owned forest or to leave them for the group account. Examples were given: Fresh wood, dry wood, grass, medicine, fruits, wild animals. Limiting the extraction to timber resources alone would have left all the players that do extract from a forest but do not extract timber with no incentive. The *sustainable* yearly harvestable amount of forest resources was announced to be 50 units for each round. Players had a decision range of 1 to 20 FR to extract from. They were informed that they could extract for their private account or leave FR to the public account. FR extracted into the private account were immediately private gains, whereby FR units left in the common forest also yielded a return to each group member. Ten forest resources are equal to 1 Namibian Dollar/1 Unit = 10 cents. Regardless of extraction levels of individual players each forest unit left was rewarded by doubling it and sharing it among the five players. If the group total extracted was more than 50 units of forest resources, private returns for all forest resources were halved. However, if the group total private harvest is higher than 50 units the price of the forest resource is halved since the yearly amount is exceeded and too many small resources harvested the quality is low and the market price in Rundu, Windhoek or South Africa will be lower. Thus if all players harvest the maximum amount of 20 unit the total private harvest is 100. As 100 is more than 50 there is no communal harvest and the price per all units will be halved. Thus, each player only earns 10 points instead of 20 points for his/her harvest. Accordingly, the individual payoff function in the Extraction Game is:

$$\pi_i(x_i) = \frac{2(50 - \sum_{i=1}^n x_i)}{n} + x_i, \text{ if } \sum_{i=1}^n x_i < 50$$

$$\pi_i(x_i) = \frac{1}{2} x_i, \text{ if } \sum_{i=1}^n x_i \geq 50$$
(1)

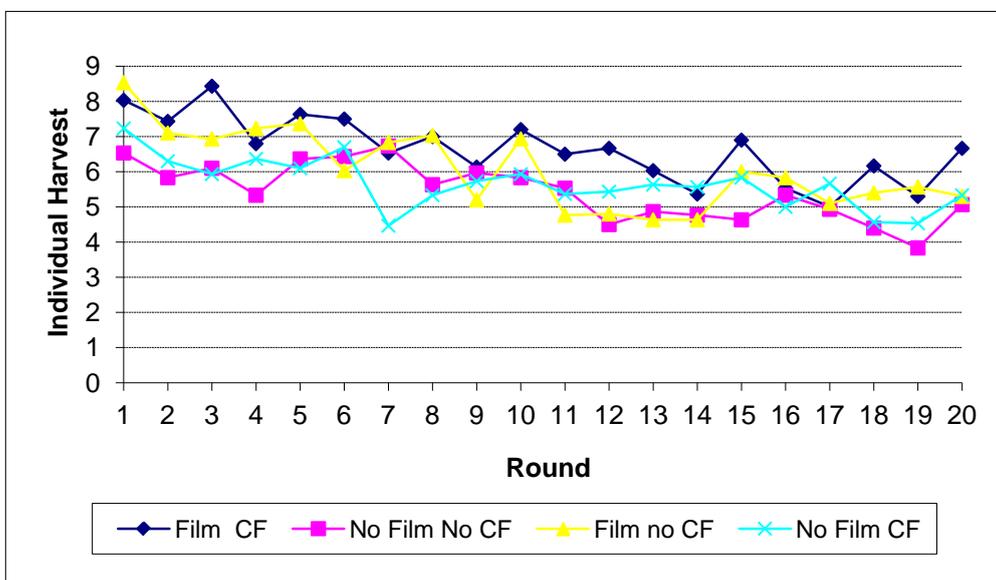
In this experimental setting as well, free riding is the dominant strategy. Because the private rewards of extracting from the public good is higher than the private rewards from the public good, individual (Nash) incentives to extract dominate. However, at the social optimum, all players would be better off if none of the players extracts any unit. After round 10, we randomly introduced two parallel treatments to be played in two different groups. After the additional 10 rounds, the end of the game was announced and players received money for each FR they gained during the game, whereby one FR was equal to 10 Namibian cents. Earnings averaged 30 N\$ in EPR and 22N\$ in IPR and each experiment lasted one to two hours.

### 3. Experiment Results

#### Results Rounds 1 + 2 and 1 – 10

For a first analytical step, we compared the average individual harvests per round per village (Figure 1).

**Figure 1.** Comparing average individual harvests per round per village.

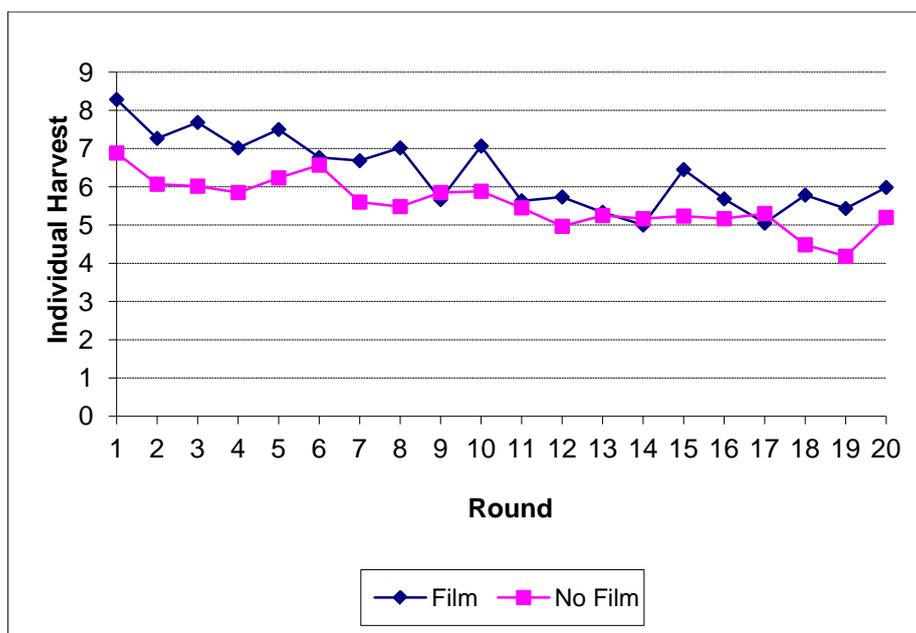


Calculating average total extractions across villages for the whole game the average extraction was 5.99 FR (Std. Dev. 0.82). In the course of the game, extraction levels were slightly decreasing. During the first 10 rounds average extractions ranged rather above total average with a sinking trend and during the additional treatments ranged largely below of it, indicating a slight impact of additional costly and competitive monitoring [16]. Although external punishment can lead to a crowding-out effect [29] most experimental studies suggest, that monitoring and sanctioning decreases free riding substantially and that these measures lead to socially more profitable outcomes, even when punishment is costly for players [30–32]. As hypothesized extractions were neither at Nash equilibrium nor at social optimum, however they were also not increasing over time. Distinguishing between villages it is apparent that extraction values in villages where the film had been screened were clearly higher than in villages where the film had not been screened (*t*-test between groups significant at the 10%-level). In fact the villages where only film or both film and community forest are known range at the upper end

of extractions while especially for the first rounds of the game the villages where the film had not been screened range below that.

That means that the hypothesis 4 of an overlap of film and community forests towards the least extractive behavior could not be verified. Furthermore it suggests that the film might not have the expected effect of adding up to already existing knowledge and benefits from community forests but may rather offer knowledge based incentives for slightly higher extractions. Only comparing the results for film vs. no film confirms the same results (see Figure 2).

**Figure 2.** Comparing average individual harvests per round for villages with and without awareness film (AF).

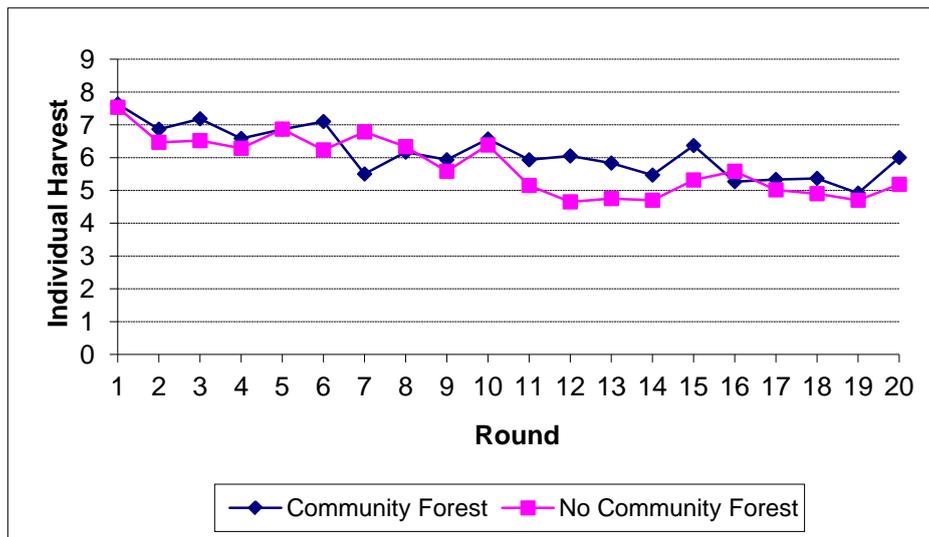


Only comparing the results of community forests shows little difference for the first 10 rounds, however it seems that with the introduction of additional treatments the villages without prior experience of CF show a less extractive reaction (see Figure 3).

We will have a close look especially at the first two rounds, as they would promise the purest results in regards to the village-comparison effects. This is the case because after round one for the first time players will have a real impression of how their own extractive behavior relates to the unknown extractions of the other players affecting the community resources. That means until then the decision should be most unbiased from other peoples’ actions and might be influenced by personal experiences of AF and CF.

Looking at round one as the first monetary real-life decision situation unbiased by a learning experience during the game we perceive a difference between the respective villages of 1.4 FR for AF (individual extraction significantly different at the 10% level) and only a difference of 0.1 FR for CF. Hypothesizing that the first real life round would be perceived as a starting point for a learning experience during the game one could argue that in case that players would be uncertain about a choice of strategy at this stage the second round would offer a significant opportunity to adapt. While first round extractions in all cases are especially high, in the second round levels decrease. However, in both cases we do find this trend happening in parallel.

**Figure 3.** Comparing average individual harvests per round for villages with and without community forests (CF).



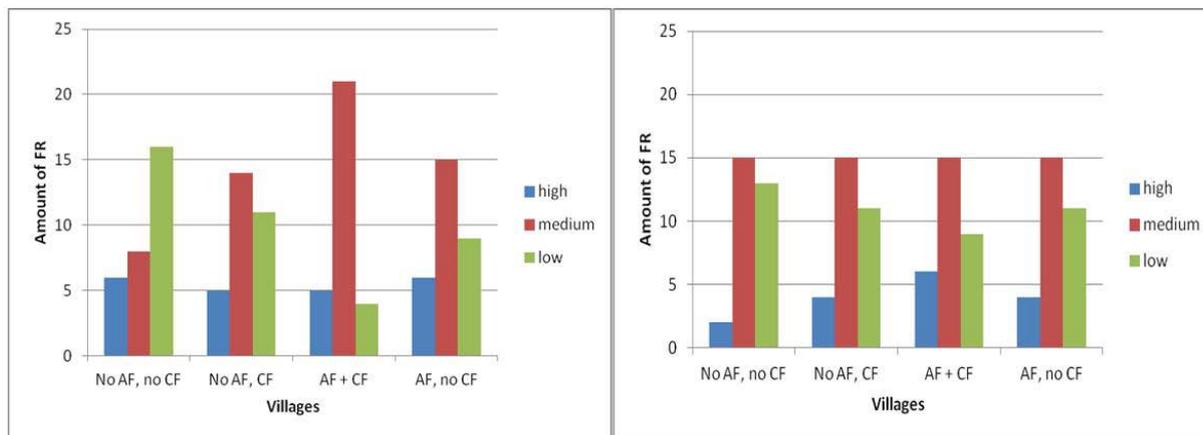
The aggregated statistical analysis based on averages is the standard strategy. However, since it might mask some individual effects we had a closer look on the variety of group and individual player strategies integrating ethnographic background knowledge. Following our hypotheses we should find AF and/or CF effects on player behavior differing between villages. We closely investigated player behavior in the first and second round, especially the variation from first to second round.

Clustering and classifying the first round contributions around the general game-average of 5.99 FR into low (below 5 FR), medium (between 5 and 10 FR) and high extractions (above 10 FR) makes potential village differences visible (Figure 4). Apparently in a situation of no previous real-game experience people who extract a high amount of resources are rather equally distributed. In the three villages that had contact with either AF or CF a medium extraction seems to be the dominant strategy. In the village where neither AF nor CF took place the largest group decided for low first-round-harvest while in the opposite case, contact with AF and CF, the large majority decided for a medium extraction. Looking at changes from first to second round it is apparent that in all villages a readjustment process towards a rather similar picture took place. However, again in the village No AF/no CF there remained the largest number of low extractors while the number of high-level extractors dropped sharply. In the village AF/CF the number of high-level extractors increased as well. This process might be interpreted again as an indicator that the instruments of AF and CF might have an influence on the distribution of player types.

We disaggregated the step from first to second round further into (a) balanced extractions (amount and thus strategy staying the same) and (b) extractions *changing* towards increase or decrease (high–medium–low). What becomes clearer, is that in all villages a broad mix of reactions/new decisions takes place, and that there is no significant difference between villages. In all villages, decreases of medium level extractions or increases of low level extractions towards a leveling as observed above took place. Furthermore, in all villages there are a small number of players sticking precisely with the chosen strategy (called balanced). Additionally, in all villages at least one player chooses to increase his already high-level extractions while this tendency is strongest in village

AF+CF where also the least high-extractors decrease their extractions and no low level extractors further decrease their harvest. Furthermore, there is a tendency among a larger fraction of the group of low extractors in the village No AF/no CF to increase their extractions.

**Figure 4.** Comparing clustered first round and second round contributions.



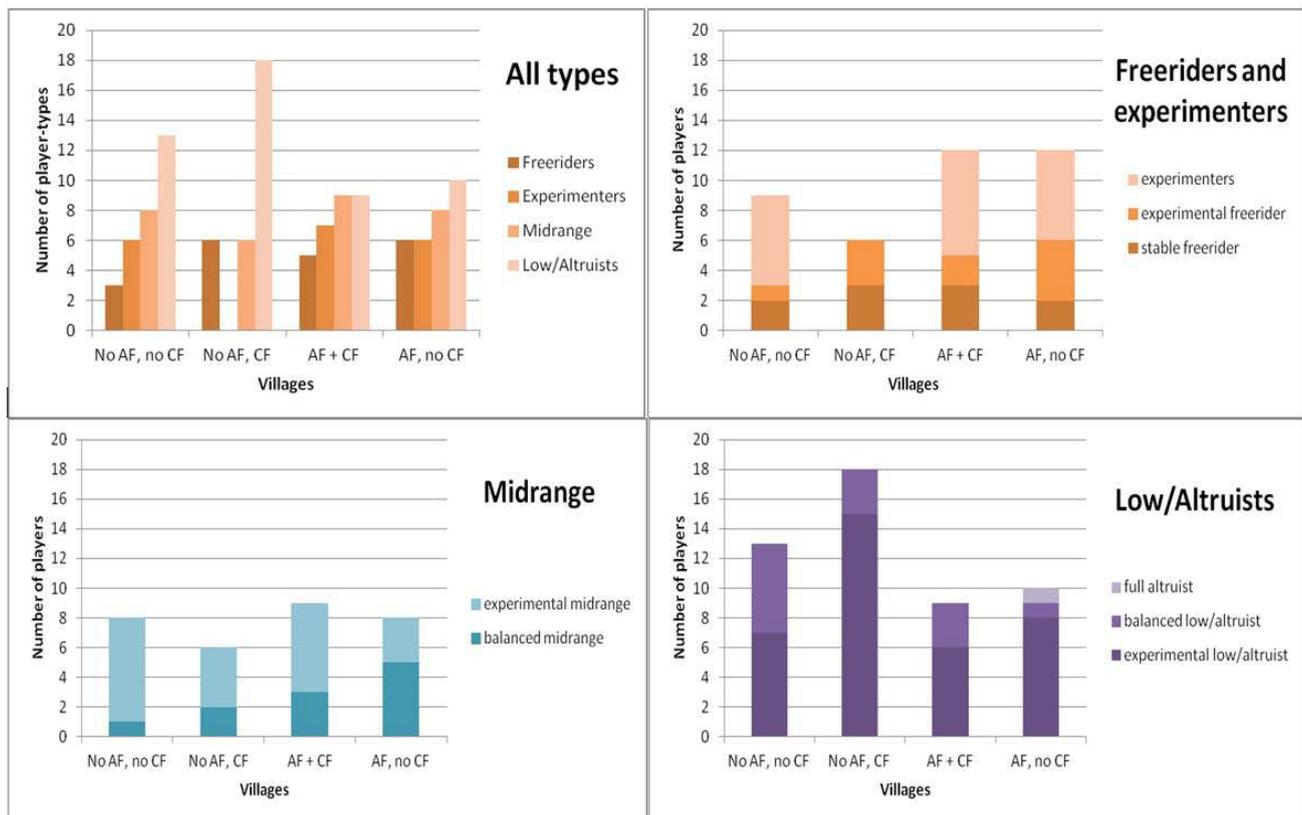
What becomes apparent looking at the harvesting strategies in the subsequent eight rounds is the fact that it is possible to identify certain player personalities [16]. A distinction was taken between free-riders (people who regularly overharvest and after 10 rounds had an average personal gain of above 10 FR), experimenters (people who clearly experiment between all sorts of extractions from very high to very low, average extractions ranging usually above midrange players), midrange players who follow either a balanced or experimental strategy with medium level extraction having an average extraction between 5 and 10 FR) and low extractors or altruists (people who either have a balanced or experimental strategy of small extractions averaging around or below 5 FR). Comparing the step from first to second round and then classifying the decisions taken in the following eight rounds we also find a high congruence—that means a high stability of strategies through the first 10 rounds of the game—in 95 cases being well distributed across all player types and all four villages. Among the remaining 25 players we find a large fraction of 13 persons who clearly experimented across the ten rounds between all sorts of extractions. One person, a headman, started out with low extractions and during the course of the game turned into a full free-rider.

In Figure 5 we illustrate the distribution of player types across villages in an aggregated way and by only grouping the single types. Results indicate that the main player types, namely free-riders, midrange players, and low-players appear in all villages. Freeriders can be further disaggregated into stable freeriders (persons who clearly and constantly extracted high amounts) and experimental freeriders (persons who often extracted high amounts but also had few rounds with lower extractions).

Though not depicted here we find that these types are distributed across gender and ages. However, it is apparent that in the two villages where the awareness film was not shown there are more low player/altruists and in the village No AF/no CF we find the least freeriders. In sum, one might carefully argue that the awareness film might bear some incentive on especially the low players to rather experiment or at least secure a midrange “share of the cake”. In sum however we have to conclude that comparing villages neither AF nor CF have a clear short term effect on personal extraction

strategies which seem to be rather informed by personality, surrounding culture, communication and economic pressure.

**Figure 5.** Classified and clustered player types and single groups of player types per village.



This equally important message that under game conditions, an artificial situation with bounded anonymity liberated from communication, a lot of players followed rather stable individual strategies will be further traced. Post-game interviewing was destined to shed some additional light on players immediate (self-)perceptions. In an aggregated form, these data have limited explanatory power for individual differences in strategies. 99% of the participants enjoyed the game experience and the way they played which was mainly incited by the fact that they won money. Equally, 99% voiced the conviction that illegal harvesting of valuable forest species is a serious problem that makes them angry and that natural resource management and protection are of importance. Meanwhile on average players judged the status of the village resources to be 2.3—that is ranging between good = 2.0 and ok = 3.0. However, also 97.5% of the participants were convinced that traditional authorities do enough to prevent the consequences of logging.

Interestingly, only 60.8% were intending to talk about their strategy after the game and only 25.8% intended to compare their gains with others. These data indicate that a basic awareness of resource problems and personal responsibilities as part of collective responsibilities exists in a post-game situation (see Table 2).

**Table 2.** Percieved responsibilities for natural resource protection.

Who is, in your opinion, responsible to protect natural resources in your village? (N = 120)	
Myself	7
Government	2
Trad. Authorities	10
Community	33
Dept. of Forestry	12
All together	56

However, as much as an awareness film and the promotion of community forests as tools of a natural resource protection discourse and industry create necessary incentives and knowledge, they also create deference effects, the internalization of the socially acceptable and ecologically “correct answers” [25].

To limit especially such deference and acquiescence effects and to approach real-life decision-making these data have to be accomplished with ethnographic background knowledge which can be provided by looking at a few exemplary players cases as embedded into social and cultural background. For the question of effects of awareness and control on forest harvesting especially the group of freeriders having the strongest impact on the common resource base [16], and strong altruists, potentially having an impact as social models in a real-life setting of high social interaction and communication are most interesting. Likewise, we will look at certain key individuals as political leaders and community forest officials.

In the whole sample we found one unconditional altruist who consequently targeted at the social optimum by extracting 0 FR through all ten rounds. Konstantinus H. (pseudonym—like all names) was 35 years old at the time of the game, a married catholic father of three, head of his own household in the village AF/no CF, where he had been residing for nine years. He had attended school for nine years, had learned a bit of English as a mine-contract-laborer and was living mainly off subsistence farming like the majority of game participants. He was a member of the Village Development Committee (VDC) but at several encounters apart from the game had regretted a lack of cooperation within communities. He had watched the film with great enjoyment like the majority of fellow villagers but had not taken a dominant position in the subsequent discussion. He had answered the post-game questions in the same tenor as many other villagers, expressing enjoyment about the game but ecological concerns. However, being a rather modest and shy person he had also stated that he would not talk to others about his strategy but would compare gains with others. The fact that he was the only one consequently targeting the social optimum, while certainly aware of the extractive behavior of many others, is an indicator of his conscious decision. However, talking openly about a deviant moral behavior is risky as it can be perceived as a overly pro-social behavior that can cause anti-social sanctions [33], something we found in rounds 11–20 as well and will report elsewhere. Thus, Konstantinus represents a player type grounded in rural subsistence with deep convictions, which however would not lead to an overtly pro-social attitude. His rather low gains of 19N\$ which he was moderately satisfied with were intended to support his family with small scale items like washing powder.

Konstantinus played in the same session as Severinus G., a 24 year old young man and son of the local headwoman who had accomplished grade 12 in school, a rare and costly achievement under rural conditions. He was intending, with the strong support of his mother, to use his qualification for a future

outside of village life and farming, a strategy that at one time would turn him into a remittance giver, a highly valued source of cash and thus social security. Severinus played as a full-scale free rider, who extracted the maximum of 20 points almost in every session. Like the abundant majority, he also expressed his concerns about future problems of resource overharvesting in the post game survey, and claimed to have learned something about appropriate harvesting and resource management. He expressed that in the village one has to be careful not to be taken advantage of. During the game he entirely relied on a selfish strategy that earned him 42 N\$ and made him the top earner of the whole game. He intended to talk about his strategy and openly showed his gains, which he planned to invest into credit for his cell phone.

Looking at socioeconomic background, age and gender, the two men are no outliers or untypical cases. There are family fathers and young men among other personality types. Strong freeriders—emphasizing the necessity for natural resource protection and the learning effects of the game—were present as well. Anastasia U. (35), a woman who was known to be in constant need of cash as she liked to drink alcohol, and had spent her whole life in the village as a farmer, had her own household and four years of education, intended to talk about her strategy and stated that she planned to invest her gains into small scale items like washing powder; Gloria, K. (19), a well-educated and outspoken young single mother and farming household member, for one year in the village, with nine years of schooling; and Gerald S. (39), a very popular local teacher staying in the village for nine years, with a regular salary, fluent in English, with extensive knowledge about natural resource management, a role model for the youth and active in several committees.

The heterogeneity of free-rider biographies can as well be found looking at other villages. Noteworthy is the observation that in two villages, AF/no CF and No AF/no CF the headman/woman, members of the traditional authority followed a clear free riding strategy, a potential indicator for the self-perception of local elites as privileged, as in the case of Severinus. Furthermore, in the villages AF/CF and No AF/CF members of the community forest management committees were also participating. In AF/CF Marcus H. a fully trained and engaged committee chairman, who had played a strong role in consulting the making of the film and always acted as a member of the rule-enforcing institution, turned out to be an experimenter under game conditions with an average extraction of 7.7 FR and a maximum extraction of 16 FR in round 3. Interestingly, Evaristus M., also a member of AF/CF, who was known to be a very experienced local contract timber-harvester, which means a man who has performed illegal harvesting many times and was accustomed to a very low salary, played a rather humble experimentalist strategy with an average extraction of 5.6 FR and a maximum extraction of 15 FR once in round 5.

To sum up experiment results from the first 10 rounds: We find no clear difference of the effects of AF and/or CF on harvesting behavior at a village level. On average extractions of villagers in all villages are rather low, however the impact of certain experimental and free riding personality- or player-types on resources is fairly equally distributed among villages. As there are hardly any players targeting the social optimum, it seems that strategies of low players are mainly influenced by convictions of securing “a share of the cake” while not daring to overharvest under game-conditions. These strategies were confirmed in follow up interviews. Especially the self-regarding personalities called freeriders are less influenced by the instrumental impacts of AF and CF but rather prepared to take risks. They seem follow personal experiences, aspirations and the incentives of a transforming

socio-economic context. Unscrupulousness and selfishness were given as explanations by villagers for the occurrence of free-riders in follow up interviews. One could discuss whether the fact that some villages got in contact with 'modern' resource protection strategies as especially the film also has side-effects, inciting the wish to participate in the broader chain of transactions that is being depicted, and thus in a more personalized gambling strategy. Likewise, it is possible to view the findings as indicative of the fact that strategies are highly personalized and that in a very influential situation of not only ecological but as well social and economic challenges the anonymity of the game situation offers additional freedom to decouple individual choice from either problem awareness and the social control-setting.

#### 4. Discussion

We are dealing with the scientific problem that the impact of certain inputs like film on ecological awareness and ethical consumerism is not reliably measurable with established methods like interviews as they bear the risk of strong deference effects and the deviance between talk and action, especially on the side of free-riders. Likewise, it is very difficult to detect a causal relationship between novel institutions for a devolved user (self-)governance and changed behavior. We have presented a combination of ethnographic and experimental approaches. To discuss the adequacy of our methodological approach and validity of the presented results for delivering an answer to the general question of this paper on the effectiveness of AF and CF in shaping users choices we will have to address some constraining methodological and theoretical implications first.

*One shot nature of AF:* Regarding the lacking impact of the film one can argue that its one shot nature is overextending visually inexperienced recipients and that a repetition might deepen the understanding. Film may be too complex a message to be internalized at once. However, the dramatic structure of the film, the fact that the story was built up and narrated carefully and the fact that it sparked lively discussion afterwards, speak for the fact that the main argumentation was understandable at first sight. Furthermore, in the invitation for the game it was emphasized that household members, who are literate and able to calculate more complex matters, would have the best chance to represent their households.

*Sample size of experiment:* It could be argued that a choice of four villages with 30 players each is too small and that thus evidence is weak. We have to bear in mind that such experiments are being conducted under field conditions where in Kavango there are few villages yet being situated within a CF. In such circumstances of multiple potential biases certainly the validity would be greater with a higher number of villages. Rustagi *et al.* had a much higher number of 49 units called 'common user groups', however the overall sample consisted of 679 individuals meaning that the single groups were much smaller [16]. However, interpreting the results on heterogeneous individual strategies as an indicator of intra-village diversity it is questionable if a higher number of villages would produce a more stable picture regarding the differences or rather add to the diversity within villages. In sum, we consider this study as a first indicative attempt in a direction where broader studies could follow.

*Selection effect:* The selection of the sample could be biased towards villages with a high proportion of poor people, or an exceptionally high resource pressure which might then be argued to actually influence the distribution of e.g., free riding personalities. However, grounding on our experience in

the region we chose villages where land use strategies and income distribution were rather homogeneously distributed and which were known to suffer from the same resource pressure, meaning that they all suffered especially from the problem of selective and largely illegal logging. Villages differed in regards to their distance to Rundu. It could be argued that the vicinity of town might increase the salience of consumerist lifestyles and thus have an effect on the number of consumerist personalities, however we consider this threat as very weak since villages only differed in distance by 20 km.

*Game-adaptation, effect/impact, biases:* The experimental measurement promises actual behavioral data, real life choices with clear incentives. The strength of the game approach is certainly to expose individual action as incentivized by real world incentives (monetary gain symbolizing extractive gain from the forest). However, one has to object that game results are being biased by the games artificiality. The strongest problem here is the fact that choices happen in separation and isolation from the normal everyday flow of life as well as cultural and social interaction and it is unclear what distorting effect this may have. As other studies have shown there are cultural framing effects and a within game behavior *vs.* a without game behavior [34,35]. Ultimately, that might mean that people might use the protected situation of the game to free-ride under game conditions and might not do so under real-life conditions. That means the game is focusing the individual, which in the highly social African reality might rarely choose uninfluenced by the collective.

On the contrary, one could plausibly argue as well that, as the strategies indicate, certain individuals are well able to consciously take advantage of the situation and would probably do so in real-life contexts of unobserved exploitation as well. Other less individualized/self-secure actors may well activate a norm of internalized cultural/social (self-)control. This again would also account for other situations. That means that these persons, conscious scrupulous people, would probably abstain from illegal logging in the first place. These arguments also speak against the hypothesis that people might have misread the game. People who might just have misread the game would as well be careful with other public situations and public resources. However, the wide occurrence of freeriders and experimenter speaks a different language.

In sum we have to understand that choices are embedded into structure and context—processual flows. Real life choices and game choices certainly differ. Under the given conditions, we have taken the greatest possible care to adapt the experiment to the setting and interpret our data as indicating directions in a valid way. Here ethnographic observations may help to support a more general interpretation of the valid indications of experimental data—embedding them into background knowledge about the broader socio-cultural and economic context. This combination we would argue has produced first hints but could be fruitfully exploited further.

Holding onto the premise that our basic outline is reasonable, that means that a close and short term contact with AF and CF could cause a change of harvesting perspectives and strategies, we have to deal with the question why it did not—as we find no clear difference of effects of AF and/or CF on harvesting behavior at village level. Obviously AF and CF, alone and in combination, would not significantly reduce the number especially free riding personalities with a potentially harmful impact on resources from continuing. That means one time screening of film and permanent presence of CF as an institution offering a mix of benefits, additional monitoring and increased self-control in themselves are insufficient. Furthermore, we have to see that neither AF nor CF can deliver perfectly clear and unbiased messages and incentives. That means that especially the people in the AF/CF settings have

the greatest experience with the benefits but as well with the shortcomings of instruments. In the case of CF these can be e.g., experiences of power abuse, exclusion, or free riding even amongst members of management bodies and authorities [7]. Such experiences may apparently result in a disillusion with the institutional idea and its potential benefits. One might argue that on the other side the villagers in AF/CF are still rather untouched by the disillusion with AF and CF, which again could cause a more market-oriented behavior. In a generally weak institutional setting an increase of institutional enforcement would certainly decrease harvesting and the data we have gathered in the second half of the game indicate in that direction but certainly also emphasize the necessity of awareness and self control. However, pondering the combination of awareness and sufficient incentives for self-control *vs.* the incentives for ignoring knowledge and self-control it seems that the latter are stronger. In sum real life choices are more complex.

As additional ethnographic assessments and interviews have shown peoples choices have to be understood against a time dimension, the fact that people gain experiences through a temporal flow of events. Along a temporal dimension, people might as well use experiences from the past to develop certain aspirations for the future. As the ethnographic vignettes outline individual strategies are highly personalized and selfish behavior may be—as in the case of Severinus G.—influenced by his aspirations to leave the rural farming context and use any opportunity to work his way out of the rural dependency on natural resources towards a different model. In sum we view the findings as indicative of the fact that forest users strategies increasingly become personalized and that in a very influential situation of not only ecological but as well social and economic challenges the anonymity of the game situation indicates a tendency for free riding individuals to decouple individual choice from either problem awareness and the social control-setting.

## 5. Conclusion

In this paper, we have addressed the problem of human sustainability interfacing with the consequences of economic action through the voluntary harvesting and trading of timber. We have focused on the decision situation of local timber harvesters who are in a situation of complex incentives coming from value chains as well as ecological discourse and institutional setups. While considerable hopes and funds are being invested into instruments like awareness films and the devolvement of user benefits and control-duties to local communities the effectiveness of such instruments remains largely untested. It remains unclear and methodologically very challenging to assess if such very different instruments have an impact on users real life behavior.

To approach this challenge, we have presented results from an economic public goods experiment that assesses impacts of AF and CF in a comparative manner. Rather than clear village effects we find a disparate picture of distributed player personalities who seem to pursue strategies of their own rather uninfluenced by the ideas of AF and to a lesser degree CF. While the game offers an artificial background for individualized player choices and as well competitive player interaction, we argue that being backed up by ethnography it also offers valid indications for the observation that especially free riding personalities use opportunities of freedom and anonymity to decouple from discourses of ethical consumerism and social control. As Rustagi *et al.* have shown the number of free riders in a group has a significantly negative effect on monitoring [16]. In a setting of increasing social stratification,

advancing consumerism and incentives for economic “progress”, depicted in the paradigm of development, these seem to influence choices of certain self-regarding personalities in a strong way and—under game conditions in a stronger way than awareness film or the existence in a setting of a community forest. Our study contributes to the accumulating evidence suggesting that we have to consider the complex interaction between a socio-cultural, political-economic, and normative structure and the intrinsic motivations of users to better understand real-life incentives and choices causing commons problems and selfish but as well moral behavior [16,36].

In sum, this study tells us a lot about some challenges ahead. Firstly the many, and in the case of e.g., awareness films and other campaigns very costly attempts to prevent overharvesting, stop logging and so forth, are normative activities intersecting people’s life-worlds with still insufficient effects and simplistic tools. If our study suggests at all that screening the awareness film has conveyed the message to participants, that illegal harvesting is done frequently and they will fall behind if they don’t do so. This change in beliefs about others had a stronger impact on their behavior than the normative message about what one “ought to do”. The film might give customers a signal that compliance with rules is rather low, which activates a reciprocal bandwagon effect (“people are honest on condition that others are honest”) which weakens the norm of honesty [37]. Real life decision realities it seems are much more complex than virtualized ones. Secondly, science is grappling to approach such decision realities as field-lab experiments do not necessarily possess external validity for such complex environments [25,38,39]. What is needed are combinations of experiments and qualitative ethnographic data to much better adapt the labs to field conditions, or rather even natural field experiments where people act in their environment without knowing that they are being observed [25,40]. As decision realities are being embedded into flows of temporal and spatial activities, into experiences, social structure and surrounding discourses, all of which are hardly testable in an experimental setting experiment results have to be backed up and confronted with qualitative data on major impacts on people’s decisions. The result will hardly be quantifiable science; however, under the current status of rapidly transforming societies and increasing impact on resources they are the maximum we can get.

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## **Conflict of Interest**

The authors declare no conflict of interest.

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## Appendix

### Kavango Public Good Extraction Game Instructions

#### General instructions with groups of 10 before each EG Game Session:

[Thank you all for coming/returning to play this game with us]. Before we begin I want to make some general comments about what we are doing here today and explain some rules that we need to follow. We will be playing a game for real money that you will take home. You should remember that this is not Michael's and Björns's own money. It is money given to them by their university to use to do a research study. This is research—not part of a development project.

#### *Repetition of Rule 4:*

During the experiment conversation is strictly prohibited. **You cannot ask questions or talk about the game while we are in the process of playing.** If you have any questions, please ask us. A violation of this rule will lead to the exclusion from the experiment and all payments. If you have questions, please raise your hand. A member of the research team will come to you and answer your question personally. At the beginning it sounds difficult, but you really do not have to worry, as we will go through a lot of examples and we will also answer your questions in private.

#### **The decision situation**

This game is similar to a situation in which a group of people has to make decisions on how to use a forest. Now we will first introduce you to the basic decision situation. Then we will do some exercises that help you gain an understanding. During the game we will exchange different cards that we will explain soon.

The decisions you will have to make in this game consider the natural resources around you. There is a lot of things from the forest that can be used as for example.

fresh wood, dry wood, grass, medicinal plants, fruits, ANIMALS

So the forest is feeding a lot of people in a community. Some of you might think that the forest belongs to the government. But in fact the government is only *representing* the people and people can acquire the use rights so you are the actual possessors and users.

That means if you as a person acquire the right you are permitted to harvest and sell these resources for money to gain an income. Or if you as community acquire the use-rights then you are permitted to sell permits and harvest and sell these resources for money to gain an income for you and the community.

#### **For the game then this works like this:**

During the game we will play with units that will be exchanged into real money when the game is over. We will play with groups of five people. These people represent in the game one community or village that uses a certain forest area. You five people then have the decision to harvest privately for yourselves as well as collectively for sharing. In general you can earn more forest resources if you work together with your community.

Each of you and the other 4 members of the group can decide how many resources you want to take out of the forest privately. Again: These resources can be fresh wood, dry wood, grass, medicine, fruits, animals.

The remaining forest will be harvested by the community collectively and they will share the earnings. The privately harvested and collectively harvested resources you gained in the game will be exchanged to money right after the game.

You will play several rounds equivalent to years, which means that in each new round you can imagine that a new harvesting season has started. In each round, the forest has a maximum of 50 units of resources that can be harvested that are shown here in the middle of the room (e.g., a yearly maximum of tree or grass resources). So in each round we start with 50 units in the forest and each of you has to decide how much of the forest resource you yourself want to extract privately. The remaining units are harvested by the community.

At the end of the game we will sum the total number of forest resources you collected for yourself in the private and communal harvest, exchange that into real money and pay it to you. We will personally hand that to you in cash.

**Ten forest resources are equal to 1 Namibian Dollar/1 Unit = 10 cents.**

We are about to begin the game. It is important that you listen as carefully as possible, because only people who understand the game will actually be able to play it. We will also run through some examples here before we start the real game.

The BOX and ENVELOPE

To be able to play you will receive a box where you can store the forest resources from each round. [GIVE A BOX TO EVERYBODY], then you receive an envelope [GIVE AN ENVELOPE TO EVERYBODY]. This is used for exchanging DECISION CARDS and RESULT CARDS between us and you.

DECISION CARD

Then you also receive a DECISION CARD like the one I am about to show you now. These are used to indicate the units of forest resources you want to extract from the forest privately. In each round, the forest has 50 units of harvestable forest resource. Each round we start with 50 units in the forest and each of you has to decide how much of the forest resource you want to extract privately. This needs to be marked on a DECISION card. You can mark any number from 0 to 20 units of forest resources depicted on the DECISION CARD as little tree symbols. For example 1, 2, 3 units of forest resource or 8, 9, 10 and so on until 20 depending on how much you want.

All DECISION CARDS are then handed in to us. This all happens in secret. Remember ten forest units are equal to 1 Namibian Dollar, 20 units are 2 Namibian Dollar and so on.

It is very important that we keep in mind that the decisions are absolutely individual, that is, that the amount of forest resource you write down in the game cards are private and that you do not have to show them to the rest of the members of the group. I will collect the envelopes with the game cards from all participants, and will calculate the total private amount of forest resource the group decided to extract. I then announce the total private harvest of the group. To know how much forest resource is

left in the forest and can be harvested collectively, we subtract the total private harvest from 50 units.

The remaining forest will be harvested by the 5 people together. You can all earn more if you harvest the forest collectively and not private. Since it is easier for 5 people to harvest and to sell the forest resource the remaining amount will be *doubled* and divided equally through all of you. At the end, you will get the forest resource you indicated in the game card (your private harvest) plus the communal harvest which is the remaining forest times two divided by five.

For example if each of you harvests 5 forest units the total private harvest will be 25. The remaining forest is  $50 - 25 = 25$ . The communal harvest is then  $(25 \times 2)/5 = 10$ . Thus each player gets 5 forest resources from the private harvest and 10 forest resources from the collective harvest. Remember, that only if there is forest resource left and only then, we will double the forest resource that is left in the forest.

[MAKE THIS CALCULATION ON A BOARD VISIBLE TO ALL].

However, if the group total private harvest is higher than 50 units the price of the forest resource is *halved* since the yearly amount is exceeded and too many small resources harvested the quality is low and the market price in Rundu, Windhoek or South Africa will be lower. Thus if all players harvest the maximum amount of 20 unit the total private harvest is 100. As 100 is more than 50 there is no communal harvest and the price per all units will be halved. Thus, each player only earns 10 points instead of 20 points for his/her harvest.

Let us explain the game with another example:

[...MONITOR: Use the poster with the EXAMPLES for all following EXPLANATIONS...]

Each of you must decide in each round how much forest resource you want to take out of the forest. You give us your decision card in secret and we add it up. For instance, “PLAYER A” decides to extract 15 units, “PLAYER B” 6 units, “PLAYER C” 10 units and “PLAYER D” 0 units “PLAYER E” 9 then the total of the group is 40 units of forest resource. [MONITOR: SHOW DECISION CARD OF PLAYER B AND FILL IN 6 UNITS IN THE DECISION CARD]

Remember in the forest were 50 units. Now we subtract the 40 units of the group from 50 units in the forest and have 10 units left.

We will double this amount of forest resource and divide it by all members. In this example it is 10 units left, we double it to 20 units and thus everybody receives 4 units of forest resource from the communal harvest.

At the end, you will have the units of forest resource you indicated in the Game Card plus 4 units we gave to you as your share of the collective harvest.

Let’s see what every player gained:

“PLAYER A” receives 15 plus 4 units is 19

“PLAYER B” receives 6 plus 4 units is 10

“PLAYER C” receives 10 plus 4 units is 14

“PLAYER D” receives 0 plus 4 units is 4

“PLAYER E” receives 9 plus 4 units is 13

Altogether 60 units

[MONITOR: SHOW PRIVATE RESULT CARD AND COMMUNAL RESULT CARD OF PLAYER B AND PUT THEM IN AN ENVELOPE]

[...MONITOR: show in the poster with the EXAMPLE...]

Let us look at another example in the poster.

“PLAYER A” extracts 5 units

“PLAYER B” extracts 2 units

“PLAYER C” extracts 8 units

“PLAYER D” extracts 6 units

“PLAYER E” extracts 4 units

[MONITOR: SHOW DECISION CARD OF PLAYER E AND FILL IN 4 UNITS IN THE DECISION CARD]

The group total is then 25 units. 50 minus 25 is 25.25 times two is 50. 50 divided by 5 player is 10 units. So the individual gains are

“PLAYER A” receives  $5 + 10 = 15$  units

“PLAYER B”  $2 + 10 = 12$  units

“PLAYER C”  $8 + 10 = 18$  units

“PLAYER D”  $6 + 10 = 16$  units

“PLAYER E”  $4 + 10 = 14$  units

Altogether 75 units

[MONITOR: SHOW PRIVATE RESULT CARD AND COMMUNAL RESULT CARD OF PLAYER E AND PUT THEM IN AN ENVELOPE]

Now, there is a restriction. If the group private harvest is more than 50 units of forest resource, then each player only receives half of the private harvest he indicated. Let's see an example.

“PLAYER A” extracts 2 units

“PLAYER B” extracts 18 units

“PLAYER C” extracts 20 units

“PLAYER D” extracts 16 units

“PLAYER E” extracts 16 units

[MONITOR: SHOW DECISION CARD OF PLAYER C AND FILL IN 20 UNITS IN THE DECISION CARD]

The total of this round would be 62 units. There is no communal harvest and all extracted units are halved.

“PLAYER A” receives 1 unit

“PLAYER B” receives 9 units

“PLAYER C” receives 10 units

“PLAYER D” receives 8 units

“PLAYER E” receives 8 units

Altogether 36 units

[MONITOR: SHOW PRIVATE RESULT CARD AND COMMUNAL RESULT CARD OF PLAYER E AND PUT THEM IN AN ENVELOPE]

Let us look how the game works in each round.

Every round we start with 50 units of forest resource in the forest. Every player writes down, how many forest resources he wants to take out of the forest. It is very important to clarify that nobody, except for the monitor, will be able to know the number that each of you decides in each round. The only thing announced in public is the total private harvest of the group, without knowing how each participant in your group extracted. And I will not tell anyone later. It is totally secret.

It is important repeating that your game decisions and earnings information is private. Nobody in your group or outside of it will be able to know how many points you earned or your decisions during rounds. We hope these examples help you understand how the game works, and how to make your decisions to allocate your units in each round of the game. If at this moment you have any question about how to earn forest resource in the game, please raise your hand and let us know.

[...MONITOR: pause to resolve questions...]

It is very important that while we explain the rules of the game you do not engage in conversations with other people in your group. If there are no further questions about the game, then we will assign the numbers for the players and the rest of forms needed to play.

Preparing for playing:[...MONITOR: Hand out PLAYER NUMBERS]

In the following poster we summarize for you the steps to follow to play in each round. Please take your time to read through it again and raise your hand if you have any questions.

[...MONITOR: Distribute Sheet with “SUMMARY INSTRUCTIONS” pause to resolve questions until EVERYBODY has read through the instructions...]

Finally, to get ready to play the game, please let us know if you have difficulties reading or writing numbers and one of the monitors will sit next to you and assist you with these. Also, please keep in mind that from now on no conversation or statements should be made by you during the game unless you are allowed to. We will now split up two groups of five and have first a few rounds of practice that will NOT count for the real earnings, just for your practicing of the game.

[...MONITOR: Tell that we will separate groups now but that people should not be afraid if they did not fully understand the game as there will be some practice rounds and time for more questions later...]

### EXAMPLE ROUND WITH SEPARATED GROUPS

The objective of the game is to get as much forest resource as possible at the end of the rounds. This will then be converted into cash for your household.

In each round, you must decide how many units you want to extract from the commonly owned forest resource. The points you earn in each round depend on your decision and the decisions by the rest of the group, according to the explanation we gave you.

[GIVE ENVELOPE WITH PLAYER AND DECISION CARDS AND SESSION CARDS TO EVERYBODY]

(1) Steps to play in each round:

[...MONITOR: DISTRIBUTE THE DECISIONS CARDS TO THE PARTICIPANTS]

Using the DECISION CARD, decide how many UNITS you will harvest privately.

Hand in the DECISION card to me.

[...MONITOR: COLLECT THE DECISION CARDS FROM THE PARTICIPANTS. CHECK THAT THEY ARE CORRECT]

Wait for Björn or Michael to calculate the total private harvest from all the cards in the group. We will announce the TOTAL PRIVATE HARVEST, THE AMOUNT OF FOREST RESOURCE UNITS LEFT IN THE FOREST AND THE AMOUNT DOUBLED AND THEN DIVIDED BY ALL MEMBERS.

Then you receive the units of forest resources you earned in the round – we will hand out the Results on these Result Cards that you keep in your box. These contain the forest resources you extracted privately, plus the additional forest resource you get from the communal harvest of the forest resource that was left in the forest.

[...MONITOR: DISTRIBUTE THE ENVELOPE WITH THE RESULT CARDS FOR PRIVATE AND COMMUNAL HARVEST ACCORDING TO THE DECISIONS OF THE PARTICIPANTS]

Let us play another round. Start all over again from point 1.

Let's start with *two practice rounds* before the game starts and we will play for money.

[PLAY 2 OR 3 PRACTICE ROUNDS]

### **REAL GAME**

Now we start with the real game for real money. All the gains you receive from now on will be exchanged to real money, which you can take home. Now your decisions matter.

**PLEASE REMEMBER, THERE IS THE Rule that THERE IS NO COMMUNICATION WITHIN THE GROUP. Please do not make any comment to another participant or to the group in general.**

[PLAY GAME FOR TEN ROUNDS]

Now you have to decide how much forest resource you want to extract. Please mark the amount of units on the card. I will then go around collecting the cards.

[Behind the blind the researchers note how much each player extracts and announces the group total]

You have altogether extracted \_\_\_\_\_ units. In the forest were 50 units. 50 units minus \_\_\_\_\_ units is \_\_\_\_\_ units, which are left in the forest. This amount is doubled to \_\_\_\_\_ units. Each one of you will get \_\_\_\_\_ units from the \_\_\_\_\_ units left.

[The envelopes with the cards indicating the gained units from the community harvest as well as the cards with the private forest resources are returned to the players.]

Please put the result cards you got from us in the box in front of you. At the end of the game we will count all points you earned from the box and convert them into real money. Ten points are equal to one Dollar.

*After 10 Rounds two additional treatments with additional rules were introduced which are not being displayed here.*

[AFTER ALL 20 ROUNDS HAVE BEEN PLAYED]

**THE GAME IS OVER NOW. NOW YOU NEED TO STILL FILL IN A QUESTIONNAIRE WITH THE HELP OF OUR ASSISTANTS**

Player 1 please come behind the blind and bring your box and the envelope, so we can change it into real money.

Player 2 please come behind the blind and bring your box and the envelope, so we can change it into real money.

Player 3 please come behind the blind and bring your box and the envelope, so we can change it into real money.

Player 4 please come behind the blind and bring your box and the envelope, so we can change it into real money.

Player 5 please come behind the blind and bring your box and the envelope, so we can change it into real money.

**Extraction Game**  
**DECISION CARD**

MY PLAYER NUMBER : ROUND NUMBER: \_\_\_\_\_

FOREST UNITS I WILL HARVEST IN THIS ROUND PRIVATELY:

(Make a circle around the ones you want to take)



Make a circle around the ones you want to take. Count them and write amount here \_\_\_\_\_

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