

Resource tenure reforms, preferences and enforcement mechanisms: Evidence on user cooperation in Namibia

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Abstract

Institutional development in communal resource management under environmentally stress crucially depends on successful user cooperation. By adapting economic experiments to the conditions of communal areas of southern Namibia we analyze the context, evolution and stability of preferences and social norms of resource users related to cooperation which strongly affect their livelihoods, rural development and environmental sustainability. Based on a wide range of experiments combined with surveys and other empirical field methods undertaken between 2000 and 2010 we concentrate in this paper on two topics: the measure of social preferences that are detrimental to economic development and which were widely neglected in the experimental literature until recently. Second, we focus on the efficiency of internal and external enforcement mechanisms for cooperative water use within the context of participatory water management reforms in Namibia.

Key words: economic experiments, enforcement, social preferences, water reform, CBNRM, Namibia, sub-Saharan Africa,

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1. Institutional Development under Resource Pressure: The challenge

Sustainable management of natural resources in southern Africa remains essential to the debate about poverty reduction, the development of rural livelihoods (Prediger et al. 2010) but as well as to political stability and social cohesion in the region. Furthermore, Namibia is a country rich in biodiversity contributing to our global commons. However, this biodiversity is one of the most threatened in the world (Tuxill 1999) mainly due to current resource management not being sustainable in the region which accelerates at the same time soil degradation and desertification. This in turn has tremendous consequences for the livelihoods of local resource users, as natural resource use, especially livestock production at subsistence level, constitutes a major livelihood strategy for the majority of inhabitants. Grazing, forest, and partly water are common-pool resources (CPR), characterised by rivalry in consumption and costly exclusion of outside users. It has often been argued that strong formal regulations, such as on livestock numbers or water use, are necessary to prevent a further degradation of these resources in communal areas. However, external interventions run the risk of undermining existing informal arrangements, thus destabilising the community (Ostrom 1990), and of crowding-out intrinsic motivation to cooperate (Gneezy & Rustichini 2000, Fehr & Rockenbach 2003, Volland 2009).

Rural communities in developing countries are increasingly at the focus of local resource management and development initiatives. So called *community-based natural resource management* (CBNRM) approaches, encompassing forest, game, water and other natural resources, have received considerable policy and research attention in the last two decades across the world and have become an important form of development assistance. The World Bank's portfolio for community-based initiatives, for instance, is about seven billion dollars (Mansuri & Rao 2004).

Since independence in 1990, the Namibian government has been promoting CBNRM approaches and has gradually begun to devolve authority over natural resources to local users. Popular examples for local CBNRM initiatives are the communal conservancy approach and the rural water management schemes which both target on the efficient use of scarce resources. Conservancy approaches, for example, attempt to combine both wildlife conservation with endogenous economic development, aimed at the improvement of local livelihoods through a sustainable use of wildlife resources and an increase of environmental awareness among local resource users (Prediger & Kirk 2010). The conservancy approach has made remarkable progress over the last decade, as the annual income generated by

conservancies has risen from less than N\$1 million¹ in 1998 to about N\$32.45 million in 2008 and wildlife populations have increased tremendously in communal areas (NASCO 2008). Nevertheless, the impact on household level in most conservancies is rather small (Bandyophadyay et al. 2004) and many conservancies suffer from insufficient funds, poor management skills of the committee members and inadequate information sharing between officials and ordinary members. Moreover, corruption, like the misappropriation of funds by committee members or unequal benefit sharing among conservancy members, and poaching remain problems. This in turn undermines trust within communities and is crowding out members' willingness to support the conservancy and to adhere to its rules.

Another example for community-based initiatives constitutes the water point associations (WPA) which have been evolving in the course of water tenure reforms in Namibia and on which we will focus in this manuscript. Similar to conservancies, the water point associations suffer from weak enforcement as well. Members of WPA committees as well as extension officers report on local resource users who refuse to pay their monthly water fees. Interestingly, not only poor households but often the richest are those who refuse to pay. WPAs have no legal means to force resource users who are unwilling to pay the water fees to contribute, but have to rely on moral pleas. Not only rule-enforcement -which is doubtless of utmost importance for the functioning of institutions (Gibson et al. 2005)- is weak, but also the design of payment schemes itself. These problems of community-based initiatives are not specific to Namibia but seem to occur in many community-based initiatives in the region (see Mansuri & Rao 2004).

In this manuscript we propose a conceptual enforcement-framework for community-based initiatives, such as the WPAs in Namibia, and test the potentials and limitations for different kinds of enforcement (i.e. material, social and moral enforcement) in our study area, using economic experiments (chapter 4).

When formal institutions are rather weak and imperfectly enforced (as in the case of many community-based initiatives) or even non existent, as in the case of grazing and water management in the communal lands of Namibia, collective action (i.e. the pursuit of a common goal by a group) is crucial for sustainable resource management and for economic development. The success of collective action depends on social capital, which is generally

¹ N\$ = Namibian Dollar.

described in terms of trust, norms of cooperation and coordination, and networks.² In our long-term research in the region (2000-2010) we paid special attention to the investigation of social norms that promote collective action amongst resource users. We were interested in how social preferences evolve and whether they are stable over time and context. And how different institutions affect preferences? Recently, we have begun to focus on social preferences that are detrimental to economic development.

The manuscript is structured as follows: In the following chapter we shortly discuss virtues and limitations of economic experiments, as we used mainly experiments to investigate resource users' social preferences. We then present results from a very recent experimental study where we began to focus on the darker side of human behaviour and investigated the relation between (anti)social behaviour and real-life resource scarcity. In chapter 4, we propose a conceptual enforcement-framework which we tested empirically. The paper ends with a short conclusion.

2. Economic experiments as a methodological panacea? Virtues and limitation

During the last two decades experiments have become a well established empirical method in economics. We carried out experiments in the communal areas of southern Namibia mainly to gain a better understanding of the preferences (i.e. risk and time preferences) and social norms (trust, cooperation but also spite) of resource users which affect economic development in general, and resource use in environmentally threatened regions in particular. Additionally, we used experimental studies to investigate the efficiency of different institutions (e.g. Vollan 2009, Vollan et al. 2010) and to test theoretical frameworks (Falk et al. 2010).

Experiments enable researchers to test and refine theories on economic decision making as well as to investigate the efficiency of various institutions and their impact on individuals' propensities to cooperate. One of the advantages of experiments is control. Control refers to the ability to hold most factors which influence behaviour (e.g. economic returns from grazing) constant and varying only the factor of interest (in this case, the implementation of an institution) (Gächter 2009). The controlled variation of factors enables the experimenter to draw causal inferences. For example, if we observe a strong increase in cooperation after the implementation of an institution in a common-pool resource experiment while holding all

² There are several studies suggesting a positive correlation between social capital and economic growth (e.g. Knack & Keefer 1997, Knack 2002). It further seems that the long-run sustainability of policy interventions is better guaranteed in communities with higher levels of social capital (Bouma et al. 2008).

other factors constant, we could conclude that the institution helped resource users to gain more efficient outcomes, at least in our experimental set-up. In naturally occurring decision situations, on the other hand, the circumstances under which decisions occur are often unknown or unobservable to the researcher and “*cannot be influenced or occur simultaneously with other conditions, such that it is not possible to say anything about causality*” (Gächter 2009:4). In contrast to other empirical methods applied in social sciences, such as household surveys or ethnography, experiments use real monetary incentives by paying participants according to their decisions. This is a unique feature of experiments and makes them less prone to *surveyor effects*, the *idealized persona bias* and *hypothetical bias*, which are typical problems of all empirical methods applied in social sciences (Cardenas & Carpenter 2005).

However, experiments also have their pitfalls. They can lack internal and external validity and may not always yield results that are easily generalized (see for example Levine & List 2007 for a detailed discussion of methodological problems). Harrison and List (2004) argue that experimental behaviour must not necessarily spill over to actual behaviour, especially not when the experimental setting is perceived as artificial by the participants. Thus, the interpretation of experimental results and the inference on real-life phenomena must be done with care, especially when the experimental study aims at drawing policy recommendations rather than at merely testing theories. Possibilities to improve the external validity of experiments are the framing of designs according to real-life situations (see for instance Cardenas 2003, Cardenas et al. 2008, Prediger et al. 2010). External institutions interact with behavioural norms which evolve within a certain cultural and social context (Ostrom 2000), implying that some institutions can work well in one society but may not yield the desired outcomes in another where social norms and the cultural, historical or ecological contexts are different. Norms of fairness, cooperation, trust, and reciprocity are crucial for successful common-pool resource management and adaptation to external changes. To gain a better understanding of these norms, and to complement the controlled interactions of experiments with real-life decision-making, it is important to combine experiments with data obtained from socio-demographic or ethnographic surveys as well as in-depth expert interviews and to consider the cultural and historical background (Lesorogol 2005).

3. Resource scarcity and spite: an experimental approach

The experimental literature provides plentiful evidence on cooperative and altruistic behaviour of subjects facing social dilemma situations. It has been found that subjects are fairness-minded as they send and return money in trust games (e.g. Berg et al. 1995), propose positive amounts in dictator games or are willing to punish free-riders in public good games even if it is costly for the punisher (Fehr & Gächter 2000; Masclet et al. 2003). Recent studies have turned towards the darker side of human behaviour to investigate antisocial behaviour, which is as ubiquitous as social behaviour in the real world, and which can have a substantial (negative) impact on economic and social development (Falk et al., 2005; Fehr et al, 2008). Antisocial behaviour, such as spitefulness or nastiness, is as ubiquitous as social behaviour in real-life. General examples for antisocial behaviour is the circulation of malware and the occurrence of vandalism etc.. In our study area in southern Namibia, examples encompass refusals of large-herd owners to pay water fees or the common occurrence of former communal farmers who received a private farm from the government but nevertheless graze their animals on communal areas and just move their animals to their private plot if grazing becomes scarce on the commons.

Spiteful behaviour has been observed in experimental environments as well. Zizzo and Oswald (2001) conducted burning money experiments and observed a substantial fraction of subjects being willing to reduce others' income. However, victims of destruction were those endowed with a higher amount of money, and thus burning decisions may have been motivated by equity considerations. Abbink and Sadrieh (2009) remove inequity aversion as a potential motive for burning money in their joy-of-destruction game and observe surprisingly high frequencies of nasty behaviour among Dutch students. Evidence for spiteful preferences has been also frequently reported in public good experiments, where free-riders punished cooperative players (Cinyabuguma et al. 2006, Herrmann et al. 2008). Herrmann et al. (2008), for instance, conducted public good games in diverse societies across the world and found a substantial fraction of free-riders punishing cooperative players, especially in countries with a weak rule of law and low norms of civic cooperation. Although causality is unclear, people in more developed societies tend to behave more cooperatively and less spitefully in their study.

Given the empirical evidence for widespread spiteful behaviour and its negative effects on economic outcomes, it is of utmost importance to gain better understanding of determinants of antisocial behaviour. Here we focus on the question how preferences that are benevolent or detrimental to economic and social development are shaped by real-life resource availability.

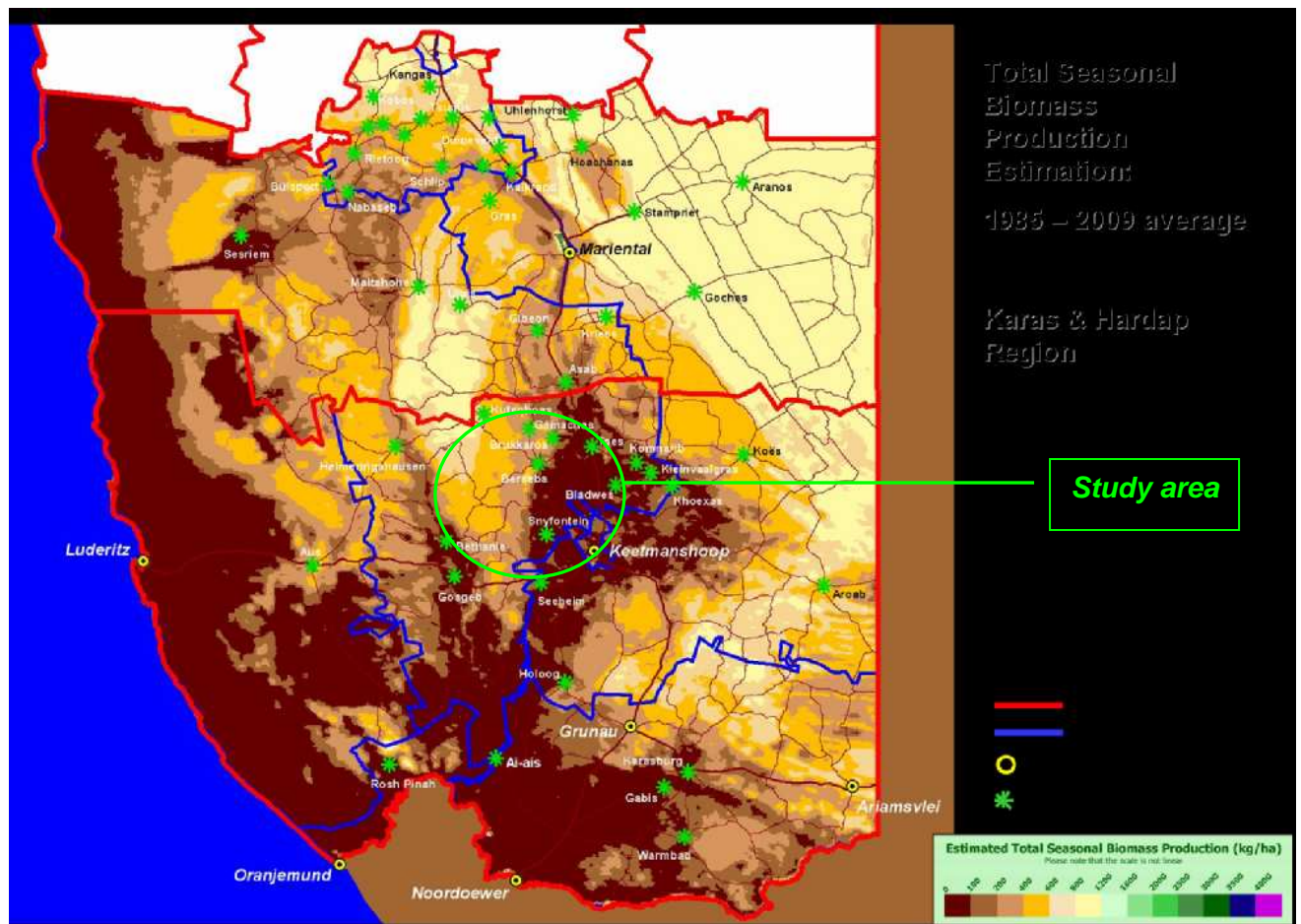
Motivated by the assumption that resource scarcity can have a strong impact on cooperation as well as on spiteful behaviour, we conducted economic experiments to investigate the relation between real-life resource scarcity and preferences. Our participants are pastoralists from southern Namibia, who share the same culture and reside in the same constituency, but face different levels of resource availability. To our knowledge, this is the first study in this vein. However, the relation between resource scarcity and social preferences is difficult to hypothesize a priori. Provided that resource scarcity increases competition among resource users, one may expect higher incidences of unsocial behaviour in communities with relative low resource availability. On the other hand, resource scarcity may require higher levels of cooperation to ensure a socially optimal use or to prevent resource degradation and thus may trigger cooperative behaviour in an experimental set-up.

3.1 The study site

In contrast to the grazing game experiments, this study was exclusively conducted in *two* areas within the Namaland in Namibia. The area is almost exclusively populated by the Nama people, who used to be semi-nomadic pastoralists before their ancestral lands were appropriated by European settlers and before they eventually were forced to sedentarization. While there are no differences regarding politics (same constituency), livelihood strategies, culture or historical developments between the two areas within the Namaland, they differ with respect to biomass production which serves as an indicator for resource availability. As shown in Figure 1, the estimated mean biomass production in our study region (encircled) varies spatially, ranging from less than 100 kg/ha up to 1200 kg/ha.³ The difference in biomass production may be attributed to different types of soils in the region.

³ The seasonal (above ground) biomass production was calculated from NOAA/AVHRR and SPOT/Vegetation satellite images, with the SMAR (Satellite Monitoring of Arid Rangeland) software based on the Monteith model. In a first step, 10-day maximum value composites were produced from normalised difference vegetation indices (NDVI) of the satellite image. Each growing season stretches from the beginning of September to the end of May (Raining season in Namibia). The data were then processed by the SMAR software package into biomass production estimates. The Monteith model of vegetation production was employed to calculate total biomass production estimation during a season (Espach et al., MAWF).

Figure 1: Map of estimated mean biomass production from 1985-2009 in southern Namibia



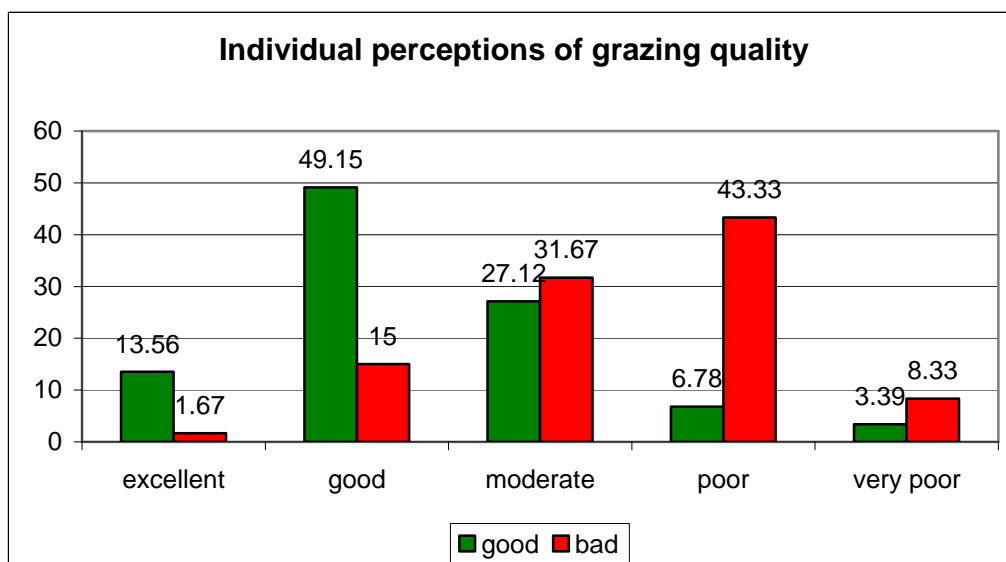
Source: Espach et al. (unpublished), Agro-Ecological Zoning Programme, *Ministry of Agriculture, Water and Forestry*: Windhoek (Namibia). **Notes:** The red lines indicate the borders of the Karas (below) and Hardap (above) region. The blue lines mark the district (municipality) boundaries. The green stars show bigger settlements and towns are marked by yellow circles. The yellow area has a relative high biomass-production and is referred to as the “good” area in our study, while the dark-brown area is classified as “bad” area.

We separated our study areas according to the biomass production into two areas: The area classified as “good” has an average estimated biomass production of 400 kg/ha up to 800 kg/ha (yellow respectively grey area in Figure 1), while average biomass production in the “bad” region is below 100 kg/ha (dark brown in Figure 1, including the settlements *Snyfontain* and *Bladwies* as well as smaller livestock posts in between). The western part of the study area, where biomass production is relative higher, is referred to as the *Swartrand* terrain characterized by rocky grounds which ease water infiltration and thus plant growth. East of Berseba begins the *Witrاند* area, a different soil type recognised as less favourable for grazing than the *Swartrand*⁴

⁴ Personal communication with Anton Losper, extension officer from the *Ministry of Agriculture, Water and Forest* in Keetmanshoop (MAWF).

Individual perceptions of resource availability in their village and surrounding area are congruent with the biological facts. On the question how subjects perceive the grazing quality and availability on their pastures, 63% of the subjects living in the good area (i.e. the area with high biomass production) answered with “good” or “very good”, compared to only about 17% of subjects who graze their animals in the bad area (Figure 2). According to a Mann-Whitney test, the answers differ significantly between the two areas ($z = 5.589$, $p < .000$). Moreover, 40% of good-area residents were the opinion that grazing in their village is much better than in most other places in the Namaland. This opinion was only shared by 16% of people living in the bad area, where most participants (42%) stated that grazing in their area is rather worse than in most other places in the Namaland. Again, the difference between the areas is highly significant ($z = 2.833$, $p = .004$). “Is there always enough grazing available in your area” is another question asked in the follow-up questionnaire. Here the vast majority (78%) of people residing on a livestock post situated in the good area answered “yes”. Contrarily, subjects from the bad area who agreed with this statement were in the minority (45%), and the difference between the areas is again highly significant ($p < .000$ according to a Fisher’s exact test).

Figure 2: Individual perceptions of grazing quality by area



3.2 Experimental set-up

In order to reveal unsocial behaviour, we conducted a one-shot version of the joy of destruction game (JOD), introduced by Abbink and Sadrieh (2009). Altogether, we held 20 sessions, 10 in each area. Each session was carried out with 6 villagers and lasted approximately 1.5 hours, including the instructions, the experiments and follow-up

questionnaires administered at individual and group level. Confounding factors, such as experimenter or language bias⁵ as well as endowment effects could be avoided, as the earnings from the experiments were determined and paid out at the end of the session, while the participants answered the questionnaires. The experiments were carried out in churches, schools and community halls in bigger settlements and open-air on smaller livestock posts where these facilities were not available.

In the JOD, two subjects were randomly matched. Both received an initial endowment of N\$10 and could decide whether or not to reduce their mate’s endowment by N\$5 at an own cost of N\$1. Thus, destruction entails no material benefits for the destroying subject. Because the game was played one-shot and decisions were made anonymously⁶, strategic aspects, such as fear of retaliation, did not matter in this experiment. There are three possible outcomes of the game: First, both subjects decide not to reduce the other’s income, as would be predicted by standard game theory. Then each subject earns N\$10. Second, each subject decides to destroy the other’s income, leaving both with N\$4. Third, one subject reduces the other’s return while the other does not, resulting in payoffs of N\$9 for the destroying party and N\$5 for the “victim” of destruction, respectively. Table 1 summarizes the payoff consequences in the JOD experiment. The unique Nash-equilibrium, to state the obvious, is the strategy pair “not burn, not burn”. Thus, assuming purely self-interested individuals, we would not expect anybody to burn her mate’s income. However, two related studies (Abbink & Sadrieh 2009, Abbink & Herrmann 2009) provide evidence that subjects deviate from their dominant strategy and indeed behave spitefully, i.e. burn their mate’s money even though this is costly to them and does result in lower personal payoffs.

Table 1: Payoff table for JOD experiment

Player B	burn	not burn
Player A		
burn	4 / 4	9 / 5
not burn	5 / 9	10 / 10

⁵ The instructions were translated into Afrikaans by a professional interpreter. A local field assistant, who was the same person in all 20 sessions, read the instructions aloud.

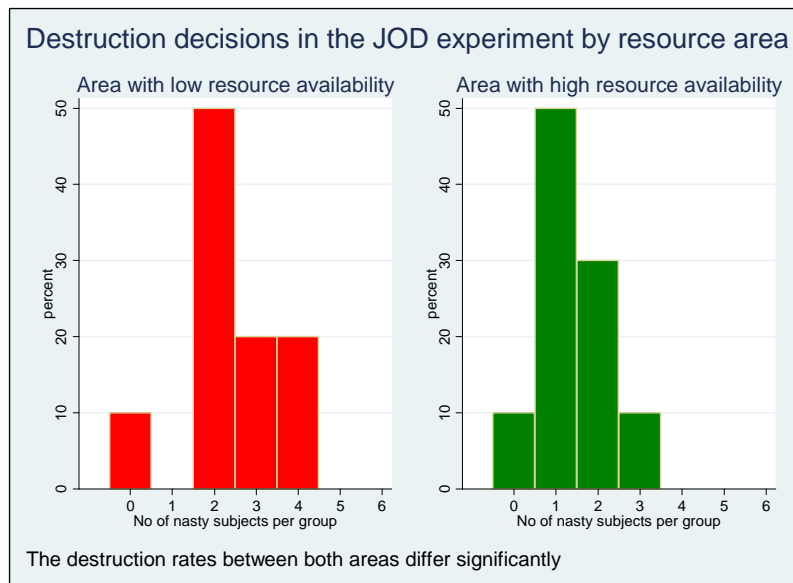
⁶ The subjects came one by one to the experimenter to take their decisions. Subjects were then shown their endowment of N\$10 and asked “Do you want to pay one dollar to reduce your mate’s income by 5 dollars?” That is, decisions were unknown to other participants but could be observed by the experimenter. Of course, it was publicly announced that decisions will never be told to others, neither during nor after the experiment. The instructions of the experiments are provided in the supplementary appendix.

3.3 Results

In our sample, 38 subjects (31.67 %) decided to “burn” the other’s income, i.e. reduced their mate’s payoff by N\$5 at an own cost of N\$1. Not surprisingly, there is strong and significant correlation ($p < .001$) between burning rates and expectations about mate’s behaviour: Those subjects who burned money tend to be those who expect their mate to burn their payoff as well.

However, we are mainly interested in behavioural difference between the good and the bad area. Figure 3 presents the distribution of the aggregate number of burning decisions per session, separated by the area. As there were 6 persons per session, the aggregate number of destruction decision can range between 0 (nobody burned money in the respective session) and 6.

Figure 3: Destruction decisions in the JOD experiment by resource area



However, in Figure 3 we can see that at maximum 4 individuals per session decided to destroy their mate’s income. This happened in 2 sessions, both conducted in the bad area (left hand side of the Figure). Interestingly, there were only two sessions where none of the subjects destroyed the

payoff of his or her mate. We further obtain different modes for the two areas. In the bad area, the mode was 2 subjects who burned money, compared to 1 subject in the good area. Comparisons at an individual level reveal that about 23% of all subjects residing in the good area destroyed money, while the fraction was 40% in the bad area. A one-sided Fisher’s exact test rejects the null-hypothesis that subjects from the good and the bad area are equally likely to burn money ($p < .04$).⁷ Thus subjects living in the area where resources are relatively scarce seem to be more spiteful in our sample.

⁷ Similarly, if regress the burning decision on area in a probit estimation, we obtain a negative coefficient for the good area which is significant at the 5% level.

In Table 2, we present results from univariate and multivariate (probit) regression analysis explaining individual burning decisions. When comparing the chi2 statistic and the pseudo R² of estimations 1 and 2, it becomes obvious that individual expectations about their mate's decision have a much stronger impact on the burning decision than subjects' origin (good or bad area). It is thus worth to take a closer look at individual expectations. In both areas, about one-quarter of all subjects assumed that their mate will burn their money, and a substantial fraction of them consequently decided to destroy their mate's payoff, most probably to avoid being the sucker: While in the good area about 69% (11 out of 16) of those who had negative expectations eventually *retaliated* anticipated unsocial behaviour of their mate, the corresponding fraction in the bad area was 93% (14 out of 15). That is, we already observe a remarkable difference between the two areas with respect to individual behaviour of those who (correctly or wrongly) anticipated unsocial behaviour of their mates, as a much bigger fraction of subjects from the good area (31% compared to only 7% in the bad area) nevertheless abstained from burning money despite their negative expectations. The difference between the areas becomes more apparent if we compare individual burning decisions of those who did *not* expect their mates to harm them. Of these subjects, at least 22% from the bad area behaved spitefully and destroyed their mate's income even though they expected their counterpart not to do so. In the good area, on the other hand, less than 7% (3 out of 44) burned money if they expected their mates to behave fairly. Taking these observations, the strong effect of individual expectations does not argue against the significant impact resource availability has on spiteful behaviour in our sample, but rather underlines the finding that subjects from the bad area behave more spitefully.

Table 2: Individual burning decisions in the JOD Game

VARIABLES	(1)	(2)	(3)	(3)	(4)	(5)
	jod_reduce	jod_reduce	jod_reduce	jod_reduce	jod_reduce	jod_reduce
good_area	-0.167** (0.083)		-0.263*** (0.095)	-0.257** (0.101)	-0.283*** (0.0986)	-0.297*** (0.106)
jod_expectation		0.660*** (0.080)	0.704*** (0.080)	0.718*** (0.082)	0.734*** (0.0810)	0.766*** (0.082)
friends				-0.039 (0.025)		-0.046* (0.027)
family				-0.038 (0.036)		-0.034 (0.036)
problems_with_participants				0.153 (0.316)		0.232 (0.360)
male					0.021 (0.099)	0.0332 (0.106)
education_grade					-0.005 (0.018)	0.006 (0.019)
farmer					-0.209* (0.121)	-0.241* (0.130)
Observations	120	120	120	119	120	120
chi2	3.885	45.36	52.86	57.22	56.18	61.15
ll	-72.98	-52.24	-48.49	-45.93	-46.83	-43.96
r2_p	0.0259	0.303	0.353	0.384	0.375	0.410

Notes: Dependent variable is the individual burning decision in the joy of destruction game, which is a categorical variable taking 1 if the subject decided to burn money. The table shows the estimated marginal effects for the probability of burning money after probit estimation. The independent variables *good_area*, *jod_expectation*, *problems_with_participants*, *male* and *farmer* are categorical variables and take 1 if the individual lives in the good area, expected his or her mate to burn money, had problems with other participants in the past, is male and if his or her main economic activity is farming, respectively. *Education* is an ordinal variable, ranging from grade 2 to grade 12, and refers to the highest grade completed at school. The variables *family* and *friends* count the number of participants who are friends or related to the individual, respectively, and range from 0 (no friends of family members in the session) to 5 (all other participants are friends or family members). *Age* is self-explanatory. The number of observations in specification 4 and 6 are due to one missing value for *problems_with_participants*. ***, **, and * indicates statistical significance at the 1%, 5% and 10% level, respectively. The standard errors are shown in parentheses.

In addition to the control variables for the area and individual expectations, we include further covariates which may explain individual burning decisions. Model 4 controls for differences in the group composition and includes the number of individual's friends and family members who participated in the same session as well as a categorical variable which takes 1 if the subject had problems with any of the other participants in the past (*problems_with_participants*).⁸ As expected, the signs of the variables "friends" and "family" are negative, implying that the more friends respectively relatives in a session are, the less

⁸ Note, the Nama people have a different comprehension of kinship than ordinary Europeans and much more people are considered as relatives.

likely an individual decides to burn money. However, just the number of friends reduces the probability significantly, and only in specification 6, where further socio-demographics are considered. Subjects who stated in the follow-up questionnaire that they had problems with other participants in the past (altogether 6 out of 120), on the other hand, were more likely to opt for destroying money, but the effect is not significant, neither in model 4 nor in model 6.⁹ In models 5 and 6 we also include basic socio-demographics like age, gender, the highest grade completed at school and a categorical variable taking 1 if the subjects' main economic activity in terms of cash income was farming. The last serves as a proxy for resource dependence, as people who live mainly from farming are more dependent on grazing than permanent and occasional workers or pensioners, which constitute the reference category. As reported in Table 2, farmers are less likely to burn the money of their mates. In both areas, 44 subjects stated to receive cash income mainly from farming. Of these farmers, 16 in the bad area respectively 10 in the good area decided to burn money. That is, farmers in the bad area behave more spitefully than those from the good area, though the result is not significant at conventional levels according to Fisher's exact test ($p = 0.121$). We ran regression analyses for restricted samples to check the robustness of the observed area effect. If we restrict our sample to farmers only (regression output available upon request), we still obtain a highly significant difference between the two areas. Similar results are obtained if we restrict our sample to people who possess livestock (available upon request).

In all models presented in Table 2, the effects of resource availability (captured by *good_area*) are highly significant. In model 6 for instance, the probability of burning other's money decreases *ceteris paribus* by roughly 30 percentage points if the subject lives in the area with relative high biomass production. Thus, people in the good area are less likely to exhibit spiteful preferences in our experimental set-up. The area-difference remains significant in multivariate specifications if we exclude the two sessions conducted in the bad area where 4 out of 6 subjects burned their mate's money from our analysis (see Table 2d in the appendix).

Univariate and multivariate results suggest a strong positive relation between real-life scarcity and spiteful behaviour in our experimental setting. It seems that a substantial fraction of subjects is willing to reduce own and the other's income for the mere purpose of increasing relative pay-off distance.

⁹ If we regress the burning decision on this covariate solely, we find a (weakly) significantly positive relation between them.

Clearly, the experimental design is abstract and it is not clear whether the behaviour observed in our experimental set-up must necessarily spill over to real-life. However, in real-life spiteful behaviour among resource users has been frequently observed in our study area: Relative well-off farmers who got granted access to private farms still use the commons; in some WPAs and conservancies ordinary members complain about widespread corruption and a substantial fraction of water users refuses to pay water fees and instead free-rides on the contributions of others. These attitudes, comparable to spiteful behaviour in the experiment presented above, can have serious negative consequences for community-based initiatives where equality, be it with respect to participation or benefit sharing, are major targets. The support of community-based initiatives greatly depends on the perceived fairness of equal benefit- and burden-sharing among participants.

The main target of this experimental study, however, was to contribute to the growing literature on antisocial behaviour, i.e. to investigate how resource scarcity affects social preferences. People do not only reveal social preferences that are conducive to economic developments, such as the willingness to punish free-riders at an own cost or to reciprocate cooperative behaviour in social dilemmas, but do also have preferences that are detrimental to economic development. The willingness to increase the own relative payoff-distance, even if this is costly to all participants, has important implications for economic development: Spiteful preferences constitute an obstacle to cooperation, which is of utmost importance in many developing countries where formal institutions facilitating cooperation are weak or absent, as well as to trade and thus detrimental to development (Fehr et al. 2008).

4. Namibian Water Reform and Water User Cooperation

4.1. The Policy Context

The lack of rural water supply is a primary constraint to development and poverty alleviation in Namibia – a challenge which is accentuated by climate change and threats such as land degradation, biodiversity losses and desertification (Republic of Namibia 2000, Falk, Bock & Kirk 2009). In order to stabilize individual livelihoods and to achieve MDG commitments on water supply, strategies are needed about future allocation mechanisms between users and capacities of user cooperation for water conservation (Bock & Kirk 2006).

In Namibia, rural water supply cannot be de-linked from the history of dualistic land ownership and post-independence land reform (Falk, Bock, & Kirk 2009). Prior to the subdivision of land for white and non-white farmers in the early 20th century no uniform

customary law was in place (Hinz 2000). Nonetheless, those who settled first were granted privileged property rights as they decided on the access to and use of water. Traditional authorities played a key role in resource management and still are responsible for granting access to and use of water in many Namibian communities.

European settlers fundamentally transformed water rights by implementing a dual system of private tenure for commercialized agriculture together with so-called communal areas receiving use rights only (Tewari, 2001). Water rights were now derived from land tenure. Under apartheid, a discriminatory agricultural policy allowed for heavy subsidization of white farmers' water use; therefore users considered water as a naturally abundant good, available at low cost (Tewari, 2001). This policy led to an extreme exploitation of aquifers and surface water (Forrest, 2001). For decades, water provision to communal areas remained overtly neglected (Falk, Bock & Kirk 2009). In 1990, only 50 percent of the rural population had access to safe drinking water (Republic of Namibia, 1996). However, rural communities received water at no cost and investments in infrastructure or operational costs were paid by the government. This further generated a perception that water is, and should remain, a free good (Chikozho, 2008).

The rural water supply reform tries to reverse these negative effects and to harmonize human and environmental ecosystems needs through a stronger involvement of stakeholders and the empowerment of water users. Strengthened incentives to save water and to maintain infrastructure are supposed to improve the ecological and financial sustainability of water supply. In addition, this would decrease government's fiscal burden and help to shift saved funds to other sectors (Republic of Namibia 1997, 2000, 2008).

The new legislation has not changed anything regarding the ownership of water resources, which still remains in the hands of the state. This legal perception is not uncontested, because state ownership is in contradiction to customary law of at least some ethnic groups which is recognised under the Namibian Constitution (Republic of Namibia, 1990; Hinz, 2000). Disregarding centralised ownership, community participation and subsidiarity are key strategies of the Namibian government. The commitment to stakeholder involvement is also a commitment to a polycentric reform approach (Falk, Bock & Kirk 2009, Andersson & Ostrom 2008) based on maximum user involvement, the delegation of responsibility to the lowest appropriate decision making level, environmentally sound water use, controlled out-sourcing, and cost recovery (Republic of Namibia, 2008). Therefore, the Water Act focuses on establishing Water Point User Associations (WPA) (Republic of Namibia, 2004) consisting of

community members who permanently use a common water point. These associations have the right and the duty to operate and maintain their water source (Republic of Namibia 2004). Examples of collectively introduced water management regulations in most WPAs are a) restrictions to waste and pollute water as well as b) limitations of water use for irrigation.

Policy makers are aware that water is a scarce and valuable resource. Therefore, it is of high priority to place an economic value on water in order to encourage enforcement mechanisms for efficient and sustainable resource supply (Republic of Namibia, 2000). However, cost recovery by water users is provoking controversial discussions. Concerns have been expressed about whether the cost recovery may not put too high a burden on water users. Cost recovery was phased in too rapidly and training was inadequate. This has resulted in poor management and maintenance (Republic of Namibia, 2000) and is assumed to have had, in turn, negative effects on rural livelihoods. This focus on equity is justified by the extreme income inequality in Namibia which is reflected in a very high Gini coefficient of 0.74 in 2007 (UNDP, 2007). Hence, the government recognises the need to adapt the implementation of the water reform to the capacity of each community to cater for itself (Republic of Namibia, 1997, 2000). This rises the question on the efficiency of different enforcement mechanisms in a resource scarce rural context where social and morale sanctions from within the group coexist with material sanctions from third parties, like the government.

4.2. Enforcement instruments: a conceptual framework¹⁰

Empirical research on enforcement mechanisms for cooperation in water management has also been carried out in the communal area of Namaland in the Karas region. Here, land and water management is vested with the state in trust of the community (Falk, 2008). We observed, however, that existing regulations are often not effective due to insufficient monitoring and enforcement of institutions governing nature-human interaction (Gibson et al. 2005). Any institution will only function if both, monitoring and enforcement, are ensured which requires the provision of costly institutional arrangements at different governance levels (Becker 1968, Crawford & Ostrom 1995, Cardenas et al. 2000, Ostrom & Nagendra 2006). These observations motivated us to analyse advantages and disadvantages of different enforcement instruments and explain how they are linked. In the logic of the Institutional Analysis and Development (IAD) framework (Ostrom et al. 1994, di Gregorio et al. 2008) we

¹⁰ This chapter is strongly based on: Falk, T., B. Vollan, & M. Kirk 2010, Analysis of material, social, and moral enforcement in natural resource management in southern Namibia. Paper accepted to be presented at the 14th Annual Conference of The International Society for New Institutional Economics (ISNIE) at the University of Stirling, Scotland, UK, June 17 - 19, 2010.

want to understand how the natural resource management arena in southern Namibia is characterized and affected by enforcement mechanisms of rules as well as norms as being attributes of a community.

Enforcement is needed if the benefits of not complying B_{NC} are higher than the ones of compliance B_C . Assuming that rule compliance would lead to socially optimal outcomes it is desirable that rules or norms are enforced so that the benefits from rule breaking are smaller than the consequences. A rational individual would no longer break the rule if [$B_{NC} - B_C < \textit{enforcement consequences}$] applies. The typical association of such consequences is a physiological or material punishment or a reward. There is, however, growing awareness that the prediction of human behaviour can be improved if one considers alternative, more internalised consequences as well (Ostrom 2008) such as self-blame or self-praise. We therefore distinguish three types of enforcement mechanisms based on the character of incentives they provide: 1. material or physiological enforcement (mp), 2. social enforcement (s), and 3. moral enforcement (m)

Material or physiological enforcement (mp) is mainly based on incentives which influence the material well-being as domain of quality of life (Cummis 1996) or physiological needs satisfaction (Maslow 1987). Common forms are fines, monetary rewards, corporal punishment, or imprisonment (Becker 1968). In a resource management context in Southern Namibia, this may be third-party enforcement including, price subsidies for livestock sales or fines assigned endogenously by a user group.

Social Enforcement (s) is based on incentives which affect the satisfaction of social, belongingness and status needs. It builds on the human strive for praise and intimacy (Cummin 1996) and the endeavour to avoid blame (Smith [1789] 2004). People comply with norms because they fear anger, hostility, social isolation, loneliness, ostracism, or rejection in the case of non-compliance (Smith [1789] 2004, Maslow 1987, Ostrom 2005, Anderson and Ostrom 2008). Incentives of social enforcement are more effective when being part of enduring relationships with frequent contacts, such as kin or friendship.

Moral Enforcement (m) in contrast does not rely on outside incentives to comply with an imperative. Ostrom (2005, 2008) relates moral enforcement to the institution of norms where internal rewards or sanctions add or deduct value to the actor's utility function.

Any institutional solution would therefore be effective if it obeys to [$B_{NC} - B_C < mp + s + m$]. In a world with scarce resources and information asymmetries it is impossible to have full detection rates of norm and rule breakers. As a result monitoring costs arise for instance from

the employment of police, guards or watchmen as well as capital input (Becker 1968). As these enforcements may be ineffective, it is uncertain that persons experience consequences for compliance or non-compliance. Therefore, the probability p to experience an incentive for a particular behaviour will be considered consciously or unconsciously in individual decision-making (Becker 1968, Crawford & Ostrom 1995) by $[B_{NC} - B_C < p_{mp} mp + p_s s + p_m m]$.

Material incentives generate the highest costs of monitoring and assigning consequences. This becomes most apparent in the case of a central government (Williamson 1983). In developing countries, insufficient material enforcement is often attributed to missing capacities of lower-level authorities (Cardenas et al. 2000, Ngaido & Kirk 2001). As a result offenders experience a low probability p_{pm} of getting caught and material/physiological incentives becoming effective. In comparison, the costs of monitoring social institutions tend to be much lower (North 1990; Ostrom 1990; Ostrom 2005). One reason is that the knowledge of relevant norms is shared by group members and not only entrusted to specialised experts such as judges (Benda-Beckmann 2002). Thus, each member of a social network is expected to help report and punish violators (Bowles & Gintis 2002). This monitoring can be carried out as part of every-day activities. The probability p_s of social enforcement being effective is therefore relatively high.

The probability p_m of moral enforcement being effective is assumed to be even higher. No extrinsic monitoring is necessary as people know whether they are right or wrong in their actions (North 1990; Searle, 2001). Morale steers behaviour very efficiently (North 1990; Ostrom 2000) because self-esteem and self-actualisation work immediately as an intrinsic mechanism and costs of monitoring for society are zero.

Whether institutionally assigned consequences for (non-)compliance become effective depends, however, not only on the effectiveness of monitoring but also on capacities and priorities of the *providers* of enforcement services. In this regard, material/physiological enforcement again shows a disadvantage: Trials at courts, imprisonment or the collection of fines are expensive (Williamson 1983), in particular, to be implemented in remote rural areas. In addition, nature conservation has not yet been of highest priority for most governments in so-called developing countries. In our context this means that keeping the judicative and executive organs busy with unsustainable range management is in conflict to budget constraints or other urgent court cases and thus associated with high opportunity costs.

Costs of social enforcement are in comparison lower. It is a public good for the group and everybody would be better off with the norm being enforced. Most people do not like,

however, to expose themselves within their community, point toward others mistakes, and generate conflicts. In theory, for the evolution of societal norms the mechanism of punishing free-riders or norm defectors at own costs without obtaining a material benefit is called strong reciprocity (Bowles & Gintis 2002, 2004; Fehr & Fischbacher 2003, 2004; Gintis et al. 2003). The willingness to provide institutional services for social enforcement is often based on moral enforcement. Social enforcement can therefore be attained at low transaction costs if they are based on group norms. The cheapest option is again moral enforcement. Even if no one learns about their actions people suffer from self-blame and enjoy self-praise (Smith, [1789] 2004; Ostrom 1990, 2005). No external costs arise in the provision of moral enforcement incentives.

In our empirical case study a variety of water provision related stakeholders are involved in providing enforcement and monitoring services. Here, we only concentrate on the two most relevant players: a) local government authorities, and b) resource users. Thus, we distinguish between material incentives provided by the government mp_g and by resource users, mp_u . Experimental evidence shows that material second-party enforcement is more effective than material enforcement by an uninvolved third party (Fehr & Fischbacher 2004). Generally, one can imagine that all stakeholders provide social incentives within their social networks. We therefore consider social incentives provided by the resource users, s_u but also by the government s_g . In the context of natural resource management the user group mainly punishes (Bowles & Gintis 2002) by influencing the satisfaction of social needs of ‘anti-social’ behaviour of group members. Last but not least, we consider internalised moral incentives which are, however, only provided by the norm addressee herself $[B_{NC} - B_C < (p_{mpg} mp_g + p_{mpu} mp_u) + (p_{sg} s_g + p_{su} s_u) + (p_m m)]$

The additive character of this last inequation indicates that different incentives can reinforce or outweigh each other. There are, however, important interactions between them. Bowles and Hwang (2008) stress that incentives are not separable and that they may complement or substitute each other. They discuss in particular how external enforcement can degrade moral one. An external incentive can signal distrust of the incentive provider and reduce the sense of self-determination. Reinforcing observable behaviour by external measures can lead to crowding out, also destroying the internal moral motivations of co-operation (Ostmann et al. 1997; Cardenas et al. 2000, Volland 2008a). External incentives can, however, also increase the confidence within the group that everybody complies with a rule. Crawford & Ostrom (1995) are concerned that moral values of previously compliant players may erode if violators are not punished. One purpose of laws and regulations is to influence moral values. Any

external incentive can cause similar effects and we therefore consider that moral incentives are amongst others a function of the social and material incentives provided by the government and users: $m = f(s_g, s_u, mp_g, mp_u)$

Having the effects of crowding in and out in mind we want to take a closer look also at the impact of norms and social incentives on external incentives provided by the government [$mp_g = f(m, s_g, s_u, mp_u)$].

A sophisticated social planner should not only have in mind incentive interactions but also the transaction costs of establishing, monitoring and enforcing institutions. Rules which are based on material incentives are more open to change than those based on social or moral ones. Even if one considers transaction-costly procedures of law-making in modern democracies, it is easier to formulate or change a rule than to establish reliable friendship or internalise values (North 2000, Ostrom 2000). This conceptual framework on enforcement mechanisms will now be combined with economic experiments in the research region.

4.4 The contribution of economic experiments

In the southern Namibian Karas region we again worked with economic experiments to test the assumptions of the conceptual framework and to bridge the gap between abstract concepts and real life observations of our case studies. As such we see economic experiments as a meaningful instrument to assess the potential in the community for the provision of moral and social enforcement and to make predictions about the probable reactions on material enforcement.

Our experimental equivalent to measure the “moral status quo” m is an *anonymous one shot trust experiment* which detects reciprocity in order to sustain a norm (Gintis 2000). It was played in 10 sessions in 8 different villages. Each player’s initial endowment was N\$ 8¹¹ Player 1 sends an amount X of its endowment to player 2. Any amount X is tripled by the facilitator before it reaches Player 2. Player 2 then receives his/her endowment plus the tripled amount sent from Player 1 and can send back any amount to Player 1. This anonymous setting reflects a pure moral decision, since both players are neither before nor after the experiment informed who their pair is.

Namaland farmers send on average 41 percent of the initial endowment. This is a standard result in trust experiments. The average proportion returned by Player 2 was 8 percent (std. dev. = 0.14) and only 30 percent of Player 2 who received money from Player 1 sent any

¹¹ Average exchange rate 2006: N\$1 = € 0.12 (<http://www.oanda.com>).

positive amount back. This indicates a very low level of reciprocity compared to other studies world wide using the same methodology (Vollan 2009). In addition we used a linear OLS-regression in order to discover the dominant motivation. The results show that a perceived unfairness of not returning money did not significantly increase the de facto return ratio. Even more surprising is that those who assume that the other farmer is needier rather returned less

Our first experiment results give the expected evidence that moral enforcement m exists within the researched community. The results show, however, that the moral dimension of fairness is seemingly not strong enough to have a larger share of the population adhere to this norm when individual material incentives are large enough. The results of the trust experiment are in line with the data from our survey on social capital with standard items from the world value survey done in the same area (N=64). Almost all (96 percent) respondents stated that when people in the community are not monitored they tend to be dishonest.

The impact of *external enforcement* was then in a second step tested by extending a simple trust experiment by a social dimension s_u and a third party punishment option mp . In the two Namaland villages we experimentally tested the impact of social relations and external material sanctions on cooperation behaviour (Vollan 2008b). This is of high relevance in Namaland natural resource management as, for instance, water supply and consumption regulations are strongly based on intra-community social enforcement (Falk, Bock & Kirk 2009). Both farmers and government threaten to enforce laws and by-laws using material consequences.

The results of the experiment the design of which is presented in Vollan 2008b are as follows: The one shot trust experiment has shown that the effectiveness of pure moral enforcement is limited. If anonymous Players 1 and 2 are now threatened with an external enforcer a still low share of 27 percent of Players 2 choose a strategy of equal sharing. Thus combining moral enforcement m with material enforcement mp increases repayment from 8 percent to 27 percent and therefore improves the social outcome only slightly. In the context of natural resource management in Namaland this means that farmers would probably not comply with a rule even if poor moral enforcement was complemented by a material enforcement such as imposing a fine.

When social enforcement s_u was introduced and the game was played among two friends 52 percent of Players 2 followed an equity norm; when the game was played among two family

members the share increased to 60 percent. Social incentives such as the fear to experience anger or disapproval therefore seem to be an effective though cheap motivator to comply with a norm. This might be an argument to give established social networks stronger authority in natural resource management. We will keep this experimentally derived hypothesis in mind when discussing water management issues.

In the same experiment we further assessed to which extent the actor's decision whether to adhere to a rule is influenced by her/his perceived probability of other's externally enforcing non-compliance. In addition, the actor might experience different degrees of self-blame/moral enforcement depending on whether she/he behaves unfair towards somebody she/he expects to have strong fairness norms herself compared to somebody she/he expects to be rather unfair. In order to predict an actor's behaviour it is consequently as important to know her/his utility function as it is to know her/his expectations of other actors.

We observe that only 6 percent of Players 2 expected a punishment from Player 3 if Players 2 treats a related Player 1 unfair. In contrast, if Player 1 is a friend 19 percent of Players 2 expected a punishment for unfair sharing and 32 percent if player 1 is a villager. Thus, the closer the social connectedness and thus the stronger the social enforcement the lower is the expected external material enforcement. Community members not only expect different enforcement instruments to be substitutes in different situations. They have internalised the logic that it is efficient to apply cheaper enforcement instruments as far as possible and use more expensive ones only where the first fall short.

To our surprise, however, players 3 did not use material punishment as supplement but as complement. On average Player 2 has been punished with N\$1.20 if he/she was unfair to a family member (22 percent of all cases) and with N\$1.64 (26 percent of all cases) if having been unfair to a friend but only with N\$ 0.76 if player 1 was a villager (14 percent of the cases). The closer the relation the more punishment is being used. This is, however, not as much a contradiction as it first appears to be. Player 3 as the external motivator is most enraged about other players violating in her/his perception fundamental community norms. Therefore Player 3 adds most value to her/his utility function in terms of self-esteem/moral enforcement if she/he punishes such norm violators. Player 2 seemingly did not consider the moral values and the utility function of the monitor. The policy implication of these results is that Namaland farmers are willing to make costly investments in external enforcement mp_u within the community if moral norms m are violated. The results further indicate that the

players hoped that external agents such as government authorities enforce rules (mp_g) which have a weaker moral or social enforcement back up.

Our results indicate that in the researched community pure moral enforcement m has low chances of success not only in controlled experimental settings but probably also in real life. There are a number of activities where farmers' cooperation could improve social welfare but where the behaviour of individuals is hardly observable. We conclude that there is a basis of moral norms in the Namaland community which might be the starting point for improved natural resource management. The value of moral enforcement should not be underestimated as it is still a cheap incentive. Nonetheless, a mere reliance on moral enforcement is risky in the researched community and the careful complementation with more external enforcement has to be considered.

In our experiments social enforcement s_u as the second cheapest instrument is an efficient motivator to adhere to institutions. In addition, community members are willing to make costly investments in material enforcement mp_u if social norms are violated. At the same time they expect an external agents to react in cases where social norms are weak (e.g. when dealing with outsiders). We further found out that there is the risk of different incentive substituting each other. The acceptance of an external incentive seems to crucially support complementarity with social and moral enforcement. This has strong implications for a sophisticated social planner and supports calls for participatory policy making (Ostrom & Nagendra 2006, Ostrom 2008). The government has not to waste resources by enforcing rules which farmers do not expect and accept to be externally enforced! Such interventions should be limited to cases where strong externalities are created outside the community. An efficient institutional framework should be based on established social networks. This requires flexible forms of authority and property rights. The government should, however, consequently provide monitoring and enforcement services where social norms are weak (see also Bowles & Hwang 2008). This again requires a flexible coordination with resource users. We will take up the experimental results and conclusions in the following summary of case studies on the regulation of water and rangeland resources in Namaland.

The two presented experiments are by far sufficient to demonstrate all different features of our conceptual framework. For instance we are not yet able to make strong statements regarding the role of the probability p of enforcement being effective (Becker 1968, Crawford and Ostrom 1995). Conclusions regarding the role of different enforcement providers still need confirmation. The most challenging task is probably to reliably measure the transaction

costs of establishing, monitoring and enforcing norms and rules. Nonetheless, most important for us was to demonstrate how we applied experimental designs to bridge the gap between a conceptual framework and real life natural resource management challenges.

4.5. Cooperation in Water Management: A case study

The described decentralised water reform approach encourages a community driven decision making process which increases the probability that the majority of users will believe in the rightness of water management rules, making it part of their internal value set (see Table 3). The reform makes use of cheaply enforceable instruments by moral and social sanctions incorporating internal user norms. Important is that through this process even smaller groups of farmers receive authority over their resource management. Our experimental finding of the special importance of social enforcement s is confirmed by the fact that water management works well in WPAs with a strong social network. In contrast, WPAs with low social cohesion are often marked by poor rule compliance (e.g. the non payment of fees). WPA constitutions usually contain the threat of material enforcement mp_u . Associations elect water point committees which have amongst other duties also the task to monitor compliance with regulations. They can officially issue fines or decide over the exclusion from water supply. The probability p_{mpu} that this happens is nearly zero as committees do not have the power to enforce the material enforcement

Table 3: Enforcement of Namaland water management

	Enforcement instrument	Resource users			Government		
		Existence of rules	Probability of consequence being effective	consequence	Existence of rules	Probability of consequence being effective	consequence
water management	Moral	Internalised but formalised in user associations' constitution. E.g.: a) payment of monthly fee; b) no water for irrigation;	p_{mu} high because norms are internalised;	m_u internal believe in their rightness;	no	$p_{mg} = 0$	m_g no
	Social		p_{su} high because based on internalised norms;	s_u gossip, showing disapproval, social exclusion;	no	$p_{sg} = 0$	s_g no
	Material		p_{mpu} Low;	mp_u Fines, exclusion from water supply	Fundamental human rights and freedoms; Legal recognition of rules of user associations;	p_{mpg} Low, because of other priorities of judiciary and executive organs;	mp_g fines;

Only as a last resort the governments' judiciary and executive organs are supposed to enforce the associations' legally recognised by-laws (mp_g). This is, however, improbable (p_{mpg}) due to their limited capacities and other priorities such as to handle capital crimes (see Table 1). Our experimental results indicate that the government should provide enforcement in cases where social enforcement is weak and users accept government enforcement. This decentralised and subsidiary approach provides incentives for more sustainable water management. To a large extent social enforcement s_u ensures compliance with rules which reduces monitoring and enforcement costs. More expensive back-up institutions provided by the government mp_g have to be applied only if the social mechanisms fail. Social enforcement fails in particular when incoherent user associations are established. The decision of which group is forming a WPA is of central importance. More emphasis should be laid on matching well established social networks and WPAs.

5. Conclusions

Our empirical research in Southern Africa has shown that when formal institutions are weak, imperfectly enforced or even non existent collective action in pasture and water management is crucial for sustainable resource management and for economic development. Economic experiments in the communal areas of southern Namibia strongly contributed to get a better understanding of the context, evolution and stability of preferences (i.e. risk and time preferences) and social norms (trust, cooperation but also spite) of resource users related to cooperation which affect rural development and resource use in environmentally threatened regions. This also includes a more recent focus on those social preferences that are detrimental to economic development.

In the joy-of-destruction experiments presented in chapter 3, we found a strong positive correlation between spiteful behaviour and real-life resource scarcity. If causality is correct, i.e. if resource scarcity increases spitefulness among resource users as our experimental results suggest, the Namibian government must be alerted as further resource depletion, caused by unsustainable use and climate change, is likely to happen. The willingness of a substantial fraction of participants to destroy other's income for the mere purpose of increasing the relative pay-off distance to them is alarming. This attitude can have serious negative consequences for community-based initiatives where equality, be it with respect to participation or benefit sharing, are major targets. The support of community-based initiatives greatly depends on the perceived fairness of equal benefit- and burden-sharing among participants. However, if more and more subjects refuse to pay and if especially farmers with

large herd sizes inhibit the implementation of a fairer payment-scheme, as has been observed in our study area, it is likely that such initiatives lose legitimacy and eventually fail.

Having analyzed different enforcement instruments we can draw the conclusion from empirical evidence that existing moral and social norms should be considered as an important starting point for any further establishment of more formal rules (Falk et al. 2010). Field experiments gave evidence that moral norms are observable but weak in the Namaland community with social enforcement having the strongest impact on encouraging cooperative behaviour. We further found evidence that smallholders are willing to make costly investments in internal material enforcement in order to reinforce social norms but expect external material enforcement in cases where social enforcement is too weak, in this sense following the principle of subsidiarity. Applying the findings to the reform of water management regulations we see close parallels between the experimental results and the fact that the rural water supply reform is making considerable progress especially within coherent social networks. New organisations established within the framework of the reform allow incorporating existing moral and social norms which decreases monitoring and enforcement costs. More emphasis should therefore be laid on the role of networks in the definition of the group which has to form a user association. More generally, our research supports the position that any formalisation of external natural resource management regulations should be first of all based on internal institutions. Going beyond water reforms these findings may sensitize national to local policy makers and donor organizations as well as in their support of land reform beneficiaries in Namibia or South Africa (Falk et al. 2010), in particular, in sharing grazing resources or developing cooperative structures in marketing, input delivery, credit or food quality improvement.

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