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Analysis of material, social, and moral enforcement in natural resource management in southern Namibia

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Abstract

In our research region in southern Namibia ineffective enforcement contributes to natural resource degradation. We analyse the root causes of ineffective enforcement applying multiple methods such as small surveys, economic experiments as well as case studies. Our conceptual framework distinguishes between moral, social, and material enforcement. Transactions costs of altering, monitoring and enforcing institutions vary depending on the used enforcement instrument. This has implications for policy making.

In a second step we analyse water and rangeland management regulations in the research area through the filter of our conceptual framework. We observe that the rural water supply reform is also making considerable progress because an institutional framework has been established which makes efficient use of different enforcement instruments. In contrast, Namaland rangeland management is characterized by ambiguous and inconsequent exogenous and endogenous material enforcement and conflicting moral norms.

In a third step we apply economic experiments in order to gain additional insights into the characteristics of selected elements of the framework in the context of our case studies. The experiments help us to bridge the gap between abstract concepts and real life observations. We found that social enforcement had the strongest impact on encouraging cooperative behaviour.

We conclude that existing moral and social norms should be considered as starting points for the establishment of formal rules because norms are more costly to establish but cheaper to apply. The rule addressees' acceptance of external material enforcement influences whether it substitutes or complements more internal enforcement.

Keywords: *enforcement, formal/informal institutions, common-pool resources, field experiments, Namibia*

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1 Introduction

Namibia is a biologically megadiverse country (Young 2002), but its biodiversity is one of the most threatened in the world (Tuxill 1999). Botanical research in southern Namibia provides strong evidence that current resource management is not sustainable (Dreber & Falk in print). An interdisciplinary team conducted research in the region for nine years assessing this complex semi-arid socio-ecological system. In this paper we will concentrate on the governance system and in particular the monitoring and sanctioning processes keeping in mind the system context as summarized in Appendix 1.[1]

Exploratory institutional analysis showed that both statutory and customary law claim to regulate natural resource management (Falk, 2008). We observed, however, that existing regulations are often not effective. As one key challenge we identify insufficient monitoring and enforcement of institutions governing nature-human interaction (see also Gibson et al. 2005). Any institution will only function if both are ensured, which requires the provision of costly institutional arrangements at different governance levels (Becker 1968, Crawford and Ostrom 1995, Cardenas et al. 2000, Ostrom and Nagendra 2006). Particularly in developing countries, the constraining factor in natural resource management is thus less a formalisation of rights but the degree and intensity of monitoring and enforcement of rules and norms (Cardenas et al. 2000).

These observations from our study site and the literature on common-pool resources (both case studies and experiments) motivated us to analyse the advantages and disadvantages of different enforcement instruments and explain how they are linked. Following from the Institutional Analysis and Development (IAD) framework (Ostrom et al. 1994) as well as the Framework for Analysing Socio-Ecological Systems (Ostrom 2007), we want to understand how decisions regarding natural resource management in southern Namibia are affected by monitoring and enforcement processes of rules and norms as attributes of a community and governance system.

Adhering to Ostrom's (2007) calls, we applied diverse complementary methods such as theory, economic experiments and case studies in order to make a contribution to the development of concepts for institutional analyses and at the same time give answers to the

[1] In order to structure the system assessment we will make reference to the second-tier SES-variable abbreviations when discussion related issues.

real life challenges of Namibian resource managers. We first conceptualise a framework distinguishing material, social and moral enforcement. In a second step we analyse water and rangeland management regulations in the research area through the filter of our conceptual framework. In a third step we apply economic experiments in order to gain additional insights regarding selected key elements of the framework in the context of our case studies. The experiments help us to bridge the gap between abstract concepts and real life observations. Our conclusions are of high relevance for ongoing and planned natural resource management reforms in Namibia and institutional design principles in general.

2 Enforcement instruments: a conceptual framework

In this chapter we develop a conceptual framework which will guide our later empirical analyses. The framework distinguishes different types of enforcement and considers transaction costs associated with each instrument.

Material, social, and moral enforcement

We approach the issue from the point of view of an individual rule addressee who must decide whether or not to comply with a rule or norm. Rules can be defined as shared understandings about actions that are obligatory, permitted, or forbidden and which encompass institutionally assigned consequences for compliance or non compliance (Ostrom 2005). Enforcement as bearing assigned consequences 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 individual's benefits from rule breaking are smaller than the consequences.[2] A rational individual would no longer break the rule if Inequation 1[3] applies.

Ineq 1: $B_{NC} - B_C <$ enforcement consequences

The typical association of institutional consequences is a physiological or material punishment or reward. The prediction of human behaviour can, however, be improved if one considers alternative, more internalised consequences as well (Ostrom 2008) such as self-

[2] From a social planner's perspective this is rational as long as the cumulated enforcement costs do not exceed the costs to society due to non-compliance (Becker 1968).

[3] We use inequations and equations to structure the paper and highlight the links between its different sections. We do not calculate equilibriums or extrema.

blame or self-praise. For our analysis we will distinguish three types of enforcement mechanisms based on the character of incentives which they provide:

1. material or physiological enforcement (*mp*)
2. social enforcement (*s*)
3. moral enforcement (*m*)

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

Social enforcement (*s*) is based on incentives which affect the satisfaction of belongingness and status needs. It is based upon the human striving 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). Social enforcement is thereby based on lengthy processes of building up and further developing reliable social relationships. The agents' utility must be affected by each other's praise or blame (Becker 1974; Fehr and Schmidt 1999). Incentives for social enforcement are more effective when part of enduring relationships with frequent contacts. This requires networks to be of relatively small scale (Bowles and Gintis 2002).

Moral enforcement (*m*), in contrast, does not rely on external 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. Moral enforcement is based on incentives influencing emotional well-being within the domain of the quality of life satisfaction (Cummin 1996, Frey and Stutzer 2002), or, in Maslow's (1987) words the satisfaction of the norm addressees' needs for self-esteem and self-actualisation. Behaviour which is motivated by a sense of moral duty does not only rely on others but on the intrinsic belief in the rightness of an action (Smith [1789] 2004, Budzinski 2003). Neuroeconomic research on brain activity gives evidence that subjects experience positive hedonic responses when they cooperate independently on receiving material incentives (Rilling et al. 2004).

Costs of monitoring and enforcement

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 the provider of monitoring has to bear costs, for instance, from the employment of police, guards or watchmen as well as other capital inputs (Becker 1968). Due to these costs enforcement may be ineffective; it is uncertain that the rule addressees experience consequences for compliance or non-compliance. Therefore, the rule addressees will consciously or unconsciously consider the probability p to experience an incentive for a particular behaviour (Becker 1968, Crawford and Ostrom 1995):

Ineq 2: $B_{NC} - B_C < p_{mp}\, mp + p_s\, s + p_m\, m;$

From the perspective of the monitoring and enforcement provider, material incentives generate the highest costs. This becomes most apparent in the case of the central government as the most typical monitor and enforcer of rules (Williamson 1983). In developing countries, insufficient material enforcement is often attributed to lack of capacity among lower-level authorities (Cardenas et al. 2000). Trials at courts, imprisonment or the collection of fines are expensive (Williamson 1983). Being aware of these costs Becker (1968) argues that enforcement costs should never exceed the costs to society due to non-compliance with a rule. Nature conservation has not yet been of highest priority for most enforcement providers. In our context this means that keeping the judicative and executive organs busy with unsustainable rangeland management is in conflict with budget constraints and associated with high opportunity costs. As a result, rule addressees often experience a low probability p_{pm} of getting caught and material/physiological incentives being effective. In our case study we will distinguish between material incentives provided by the government mp_g and by resource users mp_u.

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 entrusted to specialised experts such as judges (Benda-Beckmann 2002). Thus, each member of a social network is simultaneously monitoring and enforcement provider and addressee (Bowles and Gintis 2002). This monitoring can be carried out as part of every-day activities. The monitoring and enforcement of social norms is a costly public good. Most people do not like to expose themselves within their community by pointing out the mistakes of others and generating conflicts. The mechanism of punishing free-riders or

norm defectors at one's own expenses without obtaining a material benefit is called strong reciprocity (Bowles and Gintis 2002; Bowles and Gintis 2004; Fehr and Fischbacher 2003; Fehr and Fischbacher 2004; Gintis et al. 2003). The willingness to provide social monitoring and enforcement is often based on moral enforcement. Neuroeconomic analyses show that it is rewarding for individuals to make the investment of punishing those who do not live by the norms of the community (DeQuervain et al. 2004). Social enforcement can therefore be attained at low transaction costs if they are based on internalised norms. In such cases the probability p_s of social enforcement being effective is relatively high. In the context of natural resource management in southern Namibia, the user group mainly monitors and enforces (Bowles and Gintis 2002) by influencing the satisfaction of social needs following 'anti-social' behaviour by group members. We will therefore pay special attention to social enforcement among the resource users s_u.

The probability p_m of moral enforcement being effective is assumed to be even higher. Every person is simultaneously monitoring and enforcement provider and addressee of moral enforcement m. No external 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. Even if no one learns about their actions people suffer from self-blame and enjoy self-praise (Smith, [1789] 2004; Ostrom 1990; Ostrom 2005). No external costs arise from the provision of moral enforcement incentives. The costs of monitoring and enforcement for society are therefore zero.

Consequently, a Namaland resource user as addressee of a norm or rule will comply if:

Ineq 3: $B_{NC} - B_C < (p_{mpg}\ mp_g + p_{mpu}\ mp_u) + p_{su}\ s_u + p_m\, m.$

Interaction of incentives and costs of altering institutions

The additive character of Inequation 3 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 argue that a sophisticated social planner would adapt the intensity of external enforcement to the kind of interaction. This is one reason why the enforcement problem can not be uncoupled from crafting institutions. In the following section we will

discuss implications for the design of natural resource governance considering also the costs of establishing and altering institutions.

Bowles and Hwang (2008) discuss in particular how external enforcement can degrade moral ones. An external incentive can signal the incentive providers' distrust and reduce the self-determination and inherent incentives of the addressee. 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). External incentives can, however, also increase the confidence amongst its addressees that everybody will comply with a rule. Crawford and Ostrom (1995) are concerned that moral values of previously compliant players may erode if violators are not punished. One reason for 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:

Eq. 4: $m = f(s_u, mp_g, mp_u)$

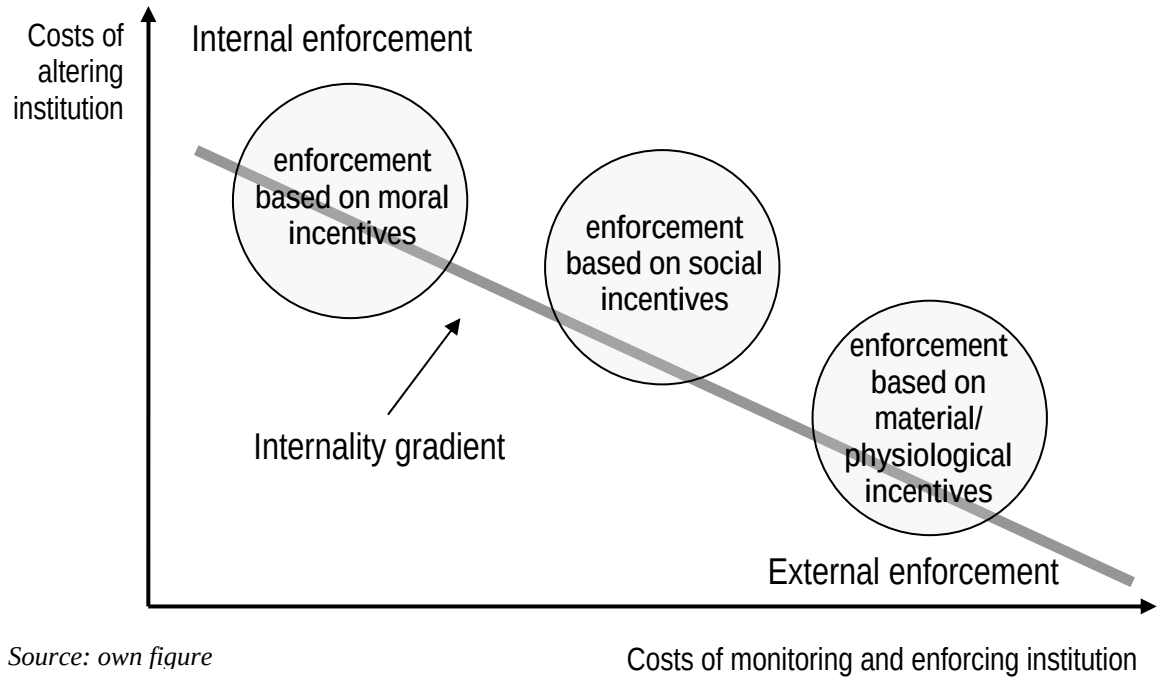
Having the effects of crowding in and out in mind, we want to also take a closer look at the impact of norms and social incentives on external incentives provided by the government:

Eq. 5: $mp_g = f(m, s_g, s_u, mp_u)$

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 friendships or internalise values (North 2000, Ostrom 2000). Both social and moral norms are built on shared cultural values, traditions, convictions, and customs (Ostrom 2005) that determine which actions are socially rewarded and which are sanctioned in a group (Coleman 1990). Norms are socially transmitted and spread from one generation to the next via lengthy teaching, imitation, and conditioning (Smith [1789] 2004, North 1990, Ostrom 2005).

Based on such theoretical discussions one can draw conclusions regarding the efficient design of institutional frameworks. Enforcement instruments can be ordered on an internality gradient. We understand internality as how close the person who provides an enforcement incentive is to the person who is the addressee of the incentive. With increasing internality the costs of altering rules grow but monitoring and enforcement become cheaper (Figure 1).

Figure 1: Transaction costs of different enforcement instruments and the internality gradient



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The relative costs of establishing, monitoring, and enforcing institutions have implications for the pathway in terms of how efficient regulatory frameworks in societies develop. North (1990) highlights that deeply rooted cultural values are preconditions for social relationships and formal institutions. He stresses that it is cheaper to adapt external enforcement to existing social institutions because the costs of altering norms are higher compared to altering rules. Ostrom (2008) argues that the actors have to agree to any institutional change which implicitly means that the change has to be internalised to a minimum degree. Formal institutions survive due only to the legitimacy bestowed by the socio-cultural system (Cleaver 2000). Weber argues that political change requires a change of norms (Weber, 1905b).

If monitoring and enforcement costs of internal enforcement are lower than those of external enforcement, it is efficient to make use of internal enforcement as much as possible and apply external ones only if internal ones fail. Therefore, existing moral and social institutions form a capital which can be applied by social planners to save monitoring and enforcement costs. At the same time, public policies that impose new rules without recognising existing intrinsic institutions can erode this capital (Ostrom 2000).

It is a challenging task for a social planner to decide upon the right level of external incentive provision. On the one hand, she/he should capitalize on the existing social capital in order to save transaction costs. On the other hand, she/he runs the risk of eroding moral and social

norms by applying external incentives. Stiglitz (2000) brought attention to this issue in which powerful governments disrupted local institutional structures without the capacity to cover the transaction costs that would replace them with anything comparably functional. Vollan (2008a) conducted a framed field experiment in Namibia and South Africa and found that the crowding-out effect depends on three factors: the degree of how controlling or supportive the external intervention is, the level of trust within a group, and the level of self-determination within the group. There are no blue-print governance solutions, rather, regulations need to be adapted to the complex systems (Gibson et al. 2005, Ostrom 2007). This is another argument supporting the call for polycentric governance (Ostrom 2005).

3 Study Area and Methodology

Empirical research has been carried out in the Karas region in the southern Namibian communal area Namaland (see Figure 2). The population density in the Namaland is 0,2 people per square kilometre. The total population consists of 5800 people. Natural resource use opportunities are very limited (Falk 2008). The average rainfall in the researched settlements is around 150 mm. The main livelihood strategy is small stock farming for subsistence use (SES-RS5). Land ownership is vested with the state in trust of the community (SES-GS4).

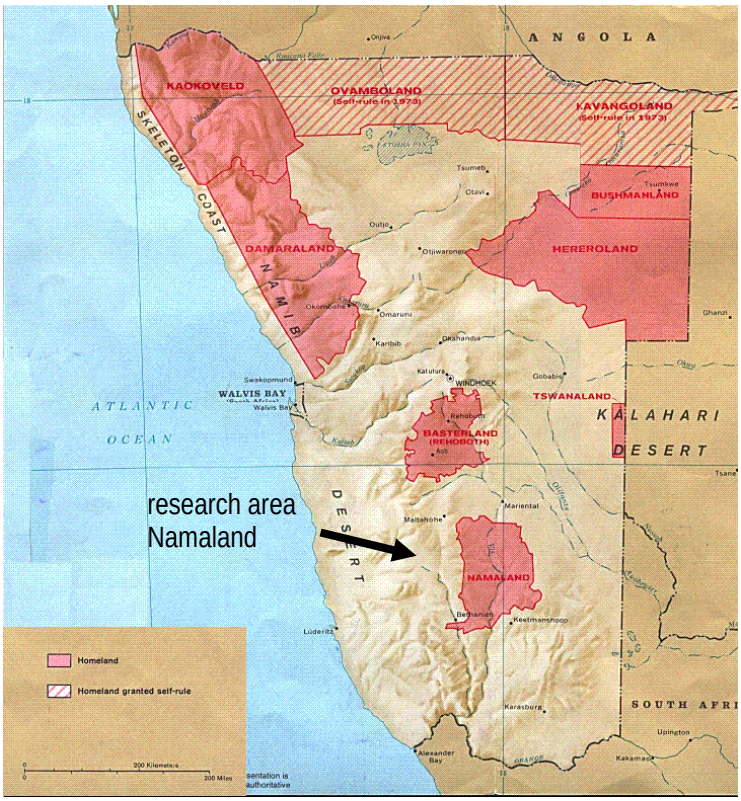


Figure 2: The Research area Namaland in Namibia. Source: Adopted from: Agricultural Office Keetmanshoop, cited by Klocke-Daffa (2001); Ben Cahoon (2000).

Table 1 gives a brief overview of the studies relevant for this article. For more details on the research designs and data analyses see Bock and Kirk (2006), Falk (2008), and Vollan (2009).[4]

[4] The studies were part of larger surveys in different regions of Namibia and South Africa. For this research paper we only analyse the data for the Namaland in southern Namibia.

Table 1: Description of different data sources and corresponding socio-demographic variables

	N	Year of research	Data collection method	Average age	Average education (years)	Proportion of male	Proportion of farmers
Analysis of natural resource management institutions	27	2003	Semi-structured interviews	56	6	78 %	78 %
Analysis of natural resource management policies	60	2004/5	Semi-structured interviews	48	4	78 %	97 %
Social Capital survey	64	2004/5	Semi-structured interviews	47	6,5	76 %	73 %
Trust Game	70	2006	economic experiments	25	10	57 %	12 %
Third party punishment game	24	2007	economic experiments	27	10	60 %	n.a.

4 Case studies on the enforcement of natural resource institutions

In the following chapter enforcement challenges in the management of water and rangeland resources in Namaland will be assessed through the filter of the conceptual framework. This will help us to understand the role of monitoring and enforcement in the specific governance systems and demonstrates the general application of the framework.

4.1 Enforcement in water management

Water is a key resource in the semi-dry environment of Namaland. Its availability strongly determines land use options. More than half of the respondents consider water availability as the most important environmental issue (B_C, SES-RU4). Ground water in the research area is sensitive to over utilisation. In low rainfall years boreholes regularly dry up (Republic of Namibia 1992, SES-O2). We will analyse how the supply and use of water as well as the maintenance of water infrastructure is managed around selected water points.

Water management in Namibia has been fundamentally reformed since the late 1990s to reverse racially-based inequities (Falk, Bock, and Kirk 2009). Ownership of Namibian and thus Namaland water resources are vested with the state which has to ensure that water is managed and used for the benefit of all people (Republic of Namibia 2004, SES-GS4). Following subsidiarity principles, the reform strongly focuses on the establishment of local water point user associations. They consist of community members who permanently use a common water point (SES-GS2). The associations have the right and the duty to operate and maintain their water source in order to foster a sense of ownership (Republic of Namibia 2004). In their constitution water users have to decide on their own locally adapted and respected water use regulations (Republic of Namibia 2001). Examples of collectively

introduced water management regulations in most WPAs are restrictions to waste and pollute water as well as limitations on water use for irrigation (SES-GS5-7).

The government regularly assesses the ability of WPAs to manage their water resources. The survey categories include management rules, financial viability, and job performance of the secretary and the caretaker.[5] The assessment shows that the performance of associations strongly fluctuates between WPAs as well as between years. Nonetheless, a positive tendency towards better management is observed (SES-O1).

The decentralised approach encourages a community driven decision making process (SES-I3) which increases the probability that a majority of users will believe in the rightness of water management rules and make it part of their internal value set (see Table 3). The reform makes use of cheaply enforceable moral and social sanctions (m & s_u) by incorporating internal user norms. Also important is that small groups of farmers (SES-U1) receive authority over the resource management. WPA constitutions usually contain the threat of material enforcement mp_u. Associations elect water point committees which have, amongst other duties, the task of monitoring regulation compliance. They can officially issue fines or decide to exclude individuals from the water supply. The probability p_{mpu} that this happens is nearly zero as committees do not have the power to enforce the material enforcement (see Table 3, SES-GS8).

Table 3: Summary of enforcement of Namaland water governance

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

[5] The most important criteria seem to be the frequency of meeting, appearance at meetings, whether minutes are recorded, whether information is passed on, whether contributions are paid by all members, whether water points are maintained, whether grazing management is adapted to the local situation, and whether plans for the management exist.

Only as a last resort are the governments' judiciary and executive organs 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 handling capital crimes (see Table 3, SES-GS8). What is important to note is that the community accepts a more polycentric water governance approach. Amongst those who see water as the most important environmental issue a quarter believes it is mainly the responsibility of the community to take care of it and one fifth acknowledges the government's responsibility (one third see water supply in the hands of nature only).

4.2 Regulations of pasture management

Many Tiervlei farmers regard fodder shortage and the lack of coordinated rangeland management as very crucial problems (Falk 2008, SES-RU4). Necessary practices include stocking rate control, strategic trampling, and seed dispersal in order to increase biomass production of the pastures. More than half of our respondents believe it is possible to apply rotational grazing in communal areas, a practice we could not observe during our studies.

Maladapted management leads to degradation and a decreasing capacity of ecosystems to provide services. During our workshops Namaland farmers stated that their rangelands severely degraded since the 1970s. Figures 4 and 5 show that over a period of six years the number of plant species and the plant cover was lower on our research site in communal Namaland (Nabaos) compared to a neighbouring government research farm (Gellap). Remote sensing data indicate that vegetation responds less to rainfall on the Namaland site and that the overall biomass production is lower (Vogel 2005, SES-O2). Our respondents feel the consequences of this situation and stress that the degradation caused a loss in productivity of the land leading to a decline of pastoral activities (SES-O1). In this section we will assess the governance system of communal pasture management focusing again on the enforcement aspect (Table 4).

The Regulations of the Communal Land Reform Act demand that communal land must be managed in accordance with accepted farming practices (Republic of Namibia 2003). Land boards (SES-GS1) may, as a form of material enforcement mp_g, suspend customary land rights if practices contradict government recommendations (Republic of Namibia 2003). The law is, however, unspecific and makes it difficult for enforcement authorities to take concrete steps (see Table 4). In addition, the monitoring and enforcement of pasture management regulations was and is not of high priority to government and judiciary systems. Farmers have

Figure 4: Plant cover depending on rainfall on Gellap and Nabaos BIOTA observatories *(source: Dreber unpublished)*

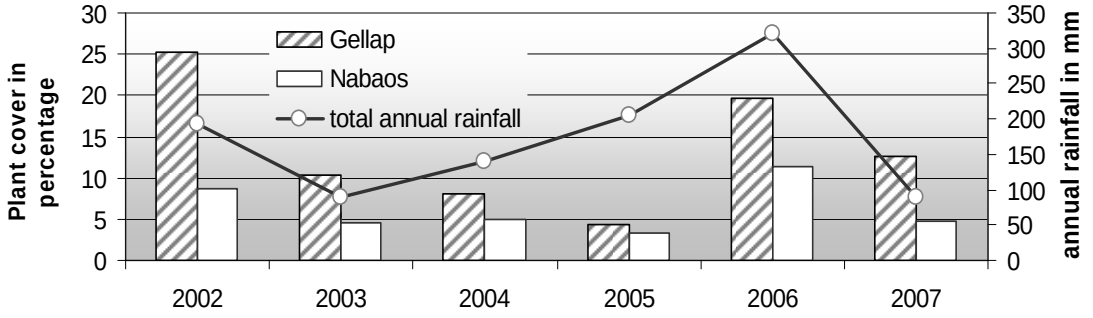
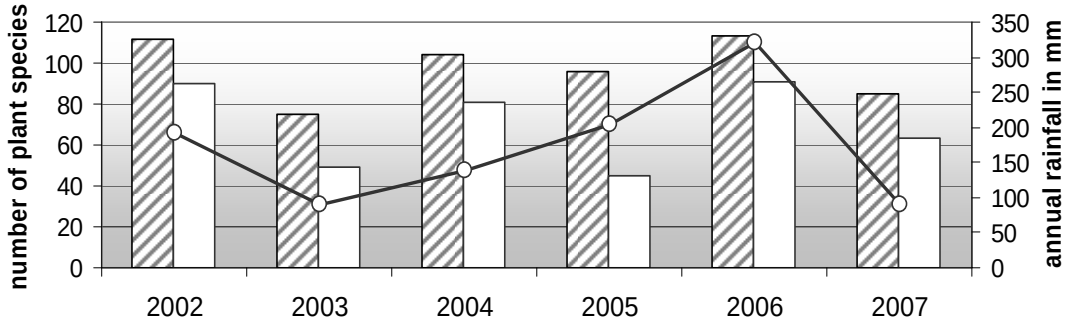


Figure 5: Species numbers depending on rainfall on Gellap and Nabaos BIOTA observatories *(source: Dreber unpublished)*



a long history of resisting external material enforcement. Colonial administrations, for example, struggled to enforce measures such as the levying of livestock fees (Kössler 2001). As a result, there is a low probability p_{mpg} that laws are enforced (SES-GS8).

Focusing therefore on moral and social enforcement (s_u, mp_u), we observe on the one hand that three quarters of our respondents support grazing control regulations. 85 percent stated that they would accept a limitation of stocking rates. Two-thirds of the respondents believe that everybody would benefit if the overall stocking rates were reduced. More than half were aware that overstocking does not lead to a social optimum (B_C, SES-O1).

Despite this awareness, two-thirds of the interviewed expressed their plans to increase their stock of animals. 60 percent believe that the rangeland has no capacity limitations. There is a widespread perception that farming is a private business and nobody has the right to interfere in private decisions. 85 percent of the farmers think that other non-environmental issues are more important to them (SES-RU4). Two-thirds complain that the impact of land-use on environmental damages is overestimated.

Conflicting norms are the main reason why neither internal nor external enforcement is effective (SES-U7). The public good of altering, monitoring and enforcing pasture management regulations is not provided even though two fifths of the respondents believe that mainly the residents establish institutions in their community. No other stakeholder was mentioned more often (Falk 2008). Amongst those who consider grazing as the most important environmental problem, two-thirds believe that it is the community's responsibility to solve it. Again two-thirds notice that community co-operation would increase their personal benefits. Most farmers feel, however, powerless. Almost half of the interviewed emphasise that they can do nothing to prevent the overuse of rangelands. Half of the respondents would not react when observing overgrazing of fellow farmers. Nonetheless, 44 percent at least stated that they would try to convince the other, which can be interpreted as the willingness to apply social enforcement.

The lack of enforcement can not only be attributed to the lack of capacity of resource users (SES-U2), less favourable attributes of the resource system (SES-RS2, RS3, RS4, RS7, RU1) or a slightly more difficult monitoring of compliance with rangeland management rules. Other examples such as the prevention of unauthorised grazing of intruders show that in fact the farmers have social and material enforcement opportunities when they have a common interest.

Table 4: Summary of enforcement of Namaland rangeland governance

Enforcement instrument	Existence of rules		Probability of consequence being effective		consequence	
Moral	a) perception of high livestock numbers as wealth indicator; b) awareness that high livestock numbers cause degradation;		p_{mu} low because norms are unclear and in conflict;		m_u a) high livestock numbers increase Self-esteem b) Weak remorse for high livestock numbers;	
Social	a) social status depends on high livestock numbers b) everybody should reduce pressure on the pastures;		p_{su} Very low, because of low acceptance ; livestock difficult to monitor;		s_u a) respect increases with larger herd; b) weak social sanctions for farmers owning much livestock;	
Material	*Resource users:* Regulations of water and land access;	*Government*: Different laws make provisions that grazing re-sources are supposed to be used sustainably	*Resource users:* p_{mpu} low because of conflicting internalised norms;	*Government:* p_{mpg} Very low, because of unspecific laws and other priorities of judiciary and executive organs;	*Resource users:* mp_u unclear; more hypothetical option to reject access to land;	*Govern-ment:* mp_g fines;

No clear framework for the development of rangeland governance exists (SES-GS). Currently the government's interventions in communal rangeland management are mainly restricted to

applying national laws as an educational instrument, which is not meant to harass farmers but rather to change their internalised moral values. Policy makers are aware of the enforcement power of moral enforcement *m* but ignore the importance of social enforcement s_u.

5 Experimental analysis of enforcement provision

In the next step we apply economic experiments in order to gain deeper insights into the relative importance of selected elements of the conceptual framework found within our case studies. In section 5.1 a one-shot trust experiment is applied to assess the intrinsic potential of moral enforcement *m*. The experiment is extended in 5.2 by social and third-party punishment elements (s_u, *mp*). In section 5.3 a real life rangeland management situation of Namaland farmers is simulated. This experiment has a higher external validity and teaches us something about the relative efficiency and the interactions of social and material enforcement (s_u, *mp*).

5.1 One shot trust experiment

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). Such norm maintenance is motivated by self-esteem and self-actualisation incentives.

The anonymous one shot trust experiment was played in 10 sessions in 8 different villages. Each player's initial endowment was N$ 8[6] 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 partner is.

Namaland people send on average N$ 3.20 which is 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 Players 2 who received money from Players 1 sent any positive amount back. This indicates a very low level of reciprocity compared to other studies world wide using the same methodology (Vollan 2009). A little more than half of Players 2 state that it would be unfair not to send anything back. Table 2 summarizes the frequencies of three potential motivations of Player 2's ratio of return. In addition we used a linear OLS-regression in order to discover the dominant motivation. The results show that a

[6] Average exchange rate 2006: N$1 = € 0.12 (http://www.oanda.com).

perceived unfairness of not returning money did not significantly increase the de facto return ratio (Table 2).

The results give evidence that moral enforcement *m* is very weak within the researched community. 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 are in line with the data from our survey on social capital with standard items from the world value survey (N=64). Almost all respondents (96 percent) stated that when people in the community are not monitored they tend to be dishonest. This highlights the strong influence poverty and apartheid may have had on norms of trust and reciprocity in Namaland.

Table 2: Descriptive and regression analysis of post experiment questions on motives for returning of Player B (N=24)

	Frequency	OLS-Regression for return rate of player B Adj R^2 = 0.2688; Prob > F = 0.0396
Motives for returning of Player B	percent	Coefficient (* p<0.05)
It would be unfair not to send anything	56	0.11
The receiver needs the money more than I do	53	-0.25*
I will get punished, either during lifetime or afterwards, if I am not generous to others.	43	0.09
Session dummy		yes[7]
Constant term		2.32*

5.2 Third party punishment experiment

Our approach to test the impact of external enforcement was to extend 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 cooperative behaviour (Vollan 2009). 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 et al. 2009). Both farmers and the government threaten to enforce laws and by-laws using material consequences.

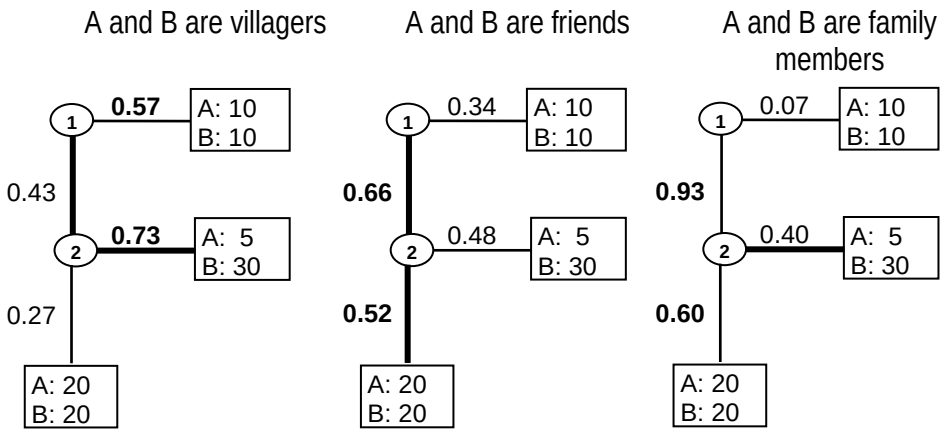
The experiment is played with three players. Player 1 is given N$10, which he/she can split evenly with Player 2; in which case the game is over. Alternatively, Player 1 can present Player 2 with two choices: a) either Player 2 can take N$ 30 out of N$ 35, leaving Player 1 N$

[7] We controlled for session fixed effects where 2 out of 3 sessions were significant.

5; or b) she can split N$40 evenly between Players 1 and 2. The unique sub-game perfect equilibrium is the (10, 10) outcome since Player 2 will always prefer N$30 over N$20. In addition, a Player 3 plays the role of an external material enforcer. The enforcer receives N$20 which he/she can keep or invest in the enforcement of cooperation simulating the costs of material enforcement. Every dollar invested in enforcement by Player 3 is multiplied by 5 and subtracted from the punished player. Thus, if Player 3 wishes to punish Player 2 with N$4 Player 2 receives N$30 – 4 x N$5 = N$10 at the end of the game and Player 3 receives N$20 - N$4 = N$16. In this way Player 3 can externally reinforce the potentially existent moral norm of fair sharing. In order to test the impact of social enforcement we further asked the participants to state how they make their decisions assuming the other players are unrelated villagers, friends or family members.[8] In order to analyse the interaction between material and social enforcement Player 3 was asked how he/she would sanction an unfair transaction between two unrelated villagers, two friends, or two family members (Vollan 2009).

The results are presented in Figure 3 by differentiating for the degree of social relations. In Section 4.2 we showed 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 (27 percent) of Players 2 choose a strategy of sharing equally. Thus, combining moral enforcement *m* with material enforcement *mp* increases repayment from 8 percent in the trust

Figure 3: Trust game with third party punishment option and differing social relations (relative frequencies of strategies) *(source: based on Vollan 2009).*



[8] Since matching of players was randomly, participants were informed that they could be paired with either one of their family member, friends or an unrelated villager. However, they could not know for sure with whom they were paired as people had to name at least two people for each category. Thus, the decision regarding kinship was not hypothetical and the experiment was anonymous as no one knew exactly with whom she/he was paired with.

game presented above 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 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 and when the game was played among two family members the share increased to 60 percent. Social incentives such as the fear of experiencing anger or disapproval therefore seem to be an effective and cheap motivator to comply with a norm. This might be an argument to give established social networks stronger authority over resource management.

From this result one can conclude that the water governance reform is also relatively successful because it integrates WPAs into existing social networks. To a large extent social enforcement s_u ensures compliance with water management 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. According to the assessments of the Directorate of Rural Water Supply, WPAs with low social cohesion are often marked by poor rule compliance (e.g. the non payment of fees).

In the same experiment we further assessed to which extent the actor's decision whether or not to adhere to a rule is influenced by her/his perceived probability of the other player externally enforcing non-compliance p_{mp}. In addition, the actor might experience different degrees of self-blame/moral enforcement depending on the expectation they have regarding the fairness norms of the other player. 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. By 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 an unrelated villager. Thus, the closer the social connectedness and the stronger the social enforcement the lower the external material enforcement expectations will be. Community members not only expect different enforcement instruments to be substitutes in different situations but have also

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 a substitute but rather as a complement. On average Player 2 was punished with N$1.20 if he/she was unfair to a family member (22 percent[9]) and with N$1.64 (26 percent[9]) if unfair with a friend but only with N$ 0.76 if Player 1 was a villager (14 percent[9]). The applied punishment is therefore greater the closer the relation between the two players. 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 fact that Players 2 expect external punishment to be applied as a substitute to social enforcement could be interpreted as the hope that external agents, such as government authorities, should exhibit material enforcement where social enforcement is weak.

5.3 Common pool resource experiment

Thirdly, a common pool resource experiment was applied in order to increase the external validity of our experimental results and to learn more about potential incentive interactions. The experiment simulates the everyday problem in communal farming in which individual harvests of a resource affect common property and is closely linked to the rangeland governance case study. The experiment is framed as a task for farmers to decide on the number of sheep (number between 1 and 9) they want to possess on jointly owned grazing land. The theoretical economic assumptions imply that individuals dealing with collective grazing resources are presumably trapped in social dilemmas that can lead to overuse. External institutions could restrict individual incentives to harvest. For example, the Communal Land Reform Act (RoN 2002) gives traditional authorities the power to determine the amount of livestock people can own. Three treatments are tested in the experiment: a) communication which allows social enforcement s_u to work, b) material incentives, and c) material disincentives mp_g. In the experiment the rule was implemented with a probability

[9] Share of all cases where Player 2 was playing unfair.

p_{mpg} of 20 percent that a person would be monitored. Thus, this reflects the real world problem of high enforcement costs for external rules.

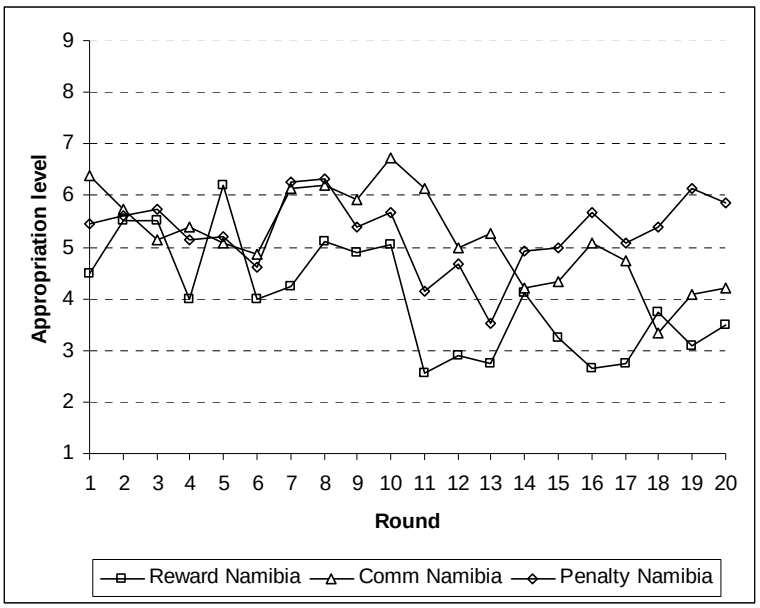


Figure 4 Results from the common-pool resource experiment in southern Namibia

Figure 4 illustrates that external punishment performed the worst. There even seems to be a crowding-out effect with practically no impact from the external penalty in the last three rounds (Vollan 2008a). The penalty rule is not only inefficient; it is also the least desired rule among the participants. In a vote after having played 10 rounds, 22 percent of the people chose the penalty rule. At the end of the game only 12 percent opted for the penalty rule. This shows that people perceive an external material negative enforcement mp_g as an inappropriate mechanism for ensuring compliance. At the same time, the players confronted with the more accepted external material positive incentive achieved the result closest to the social optimum. Acceptance can be interpreted as the accordance of external incentives *mp* with moral and social incentives (*m, s)*. Socially accepted material incentives seem to be likely complements of moral incentives rather than substitutes (see also Tyran and Feld 2006).

In the same experiment we see that social enforcement implemented by communication improved performance compared to the situation without treatment (see also Bowles 2008). From a social planners' perspective, social enforcement should therefore not be neglected as it is a cheap incentive option.

6 Conclusion and Discussion

Inspired by Institutional Analysis and Development (IAD) framework (Ostrom et al. 1994) as well as the Framework for Analysing Socio-Ecological Systems (Ostrom 2007), we developed a conceptual framework of enforcement instruments distinguishing between material, social and moral enforcement. It draws the main conclusions that existing moral and social norms should be considered as a starting point for the establishment of more formal rules because norms are more costly to alter but cheaper to apply. Efficient natural resource

governance requires the complementary use of the three instruments while bearing in mind the risk of substitution (crowding out).

Through the filter of our conceptual framework, we analysed enforcement in the water and rangeland governance in Namaland/Namibia. We come to the conclusion that the water governance system encourages sustainable resource management relatively well while the rangeland management is very poor. One reason contributing to this situation is that the characteristics of the socio-economic water system are more favourable for sustainable management than the ones of the rangeland system. Further, the water resources are valued more (B_C) contributing to stronger incentives for joint resource management. Insufficient awareness of the ecological consequences of maladapted rangeland management amongst the farmers contributed to the fact that they are not willing to provide monitoring and enforcement in this case. Due to the limited direct externalities generated by poor rangeland management (SES-O3) and capacity constraints also the government places a low priority on sustainable communal rangeland management. As a result, Namaland rangeland governance is characterized by ambiguous and inconsequent material enforcement and conflicting moral norms. We discovered in the economic experiments that material and moral enforcement are rather ineffective enforcement instruments in the Namaland community. Especially pure moral enforcement *m* is very weak and, where observable, insufficient to guide behaviour. In our experiments social enforcement s_u turned out to be efficient in motivating individuals to adhere to institutions. In the rangeland governance system no structures exist that use this instrument. We conclude that together with unfavourable SES preconditions the ignorance of social enforcement contributes to the poor management of Namaland rangeland resources leading to negative social and ecological outcomes (SES-O1, 2).

In contrast, the water governance reform allows for incorporating existing moral and social norms, which decreases monitoring and enforcement costs. Organisations are established on the basis of existing social networks and given management authority. We see close parallels between the experimental results and the fact that the rural water supply reform is making considerable progress particularly in coherent social networks. The decision as to which group forms a WPA is therefore of central importance for its success.

In the economic experiments we further found evidence that community members are willing to make costly investments in internal material enforcement mp_u if social norms are violated. At the same time we see signs that external material enforcement is expect in cases where social enforcement is weak, such as when dealing with people outside family or friendship-

networks (see also Bowles & Hwang 2008). We also discovered that there is a risk of different incentives substituting for one another. 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 and Nagendra 2006, Ostrom 2008). The government does not need to waste resources by enforcing rules which farmers do not expect or accept to be externally enforced. This requires flexible forms of authority and property rights and coordination with resource users.

We conclude that an efficient governance framework in Namaland should be based on established social networks because this makes most direct use of social enforcement which is a) most efficient in the specific community and b) relatively cheap for a social planner. Therefore, more emphasis should be laid on matching well established social networks with resource management organisations. A logical conclusion for an improvement of the unsatisfactory rangeland governance situation is a stronger integration of water and rangeland management. Some WPAs have started to extend their regulatory activities to natural resources other than water. Equally important is to increase the awareness of the links between resource use and ecological and social consequences in order to overcome inconsistencies in the value set.

Acknowledgement

This study is part of the BIOTA project (Commission number: 01 LC 0024A), which is funded by the German Federal Ministry for Education and Research. We thank the different departments of the Namibian government for their patient assistance. We are deeply grateful to the whole BIOTA team, in particular our colleagues Bernadette Bock and Nils Dreber. Special acknowledgement goes to all surveyed communities for their time and hospitality. Gratitude is extended to all our research assistants for their support and hard work. We acknowledge Ruth Meinzen-Dick for her encouraging and inspiring remarks.

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Appendix 1: Second-tier resource-system variables in framework for analyzing an SES of water and rangeland in Namaland/Namibia

Resource System (RS)		
RS1- Sector	rangelands	(ground) water
RS2- Clarity of system boundaries	Fuzzy but core area clear	Clear
RS3- Size of resource system	Small to moderate	Small
RS4- Human-constructed facilities	Poorly maintained fences	Water pumps
RS5- Productivity of system	Low carrying capacity (can only be evaluated in combination with water supply)	
RS6- Equilibrium properties	state and transition system – currently at relatively poor state	Rainfall recharging aquifer
RS7- Predictability of system dynamics	High spatial and temporal variability	mostly predictable
RS8- Storage characteristics	no	yes
RS9- Location	Semi-arid rural Namibia	
Governance System (GS)	***Matter of this paper***	
GS1- Government organizations	Formally Ministry of Agriculture, Water and Forestry, local government	Ministry of Agriculture, Water and Forestry – Directorate of Rural Water Supply
GS2- Non-government organizations	Yes but weak	Water user associations and committees
GS3- Network structure	Yes but weak	Yes
GS4- Property-rights systems	State ownership, communal use rights, and unclear decision making rights	State ownership, communal use rights, and clear decision making rights
GS5- Operational rules	Yes but weak	Yes
GS6- Collective-choice rules	Yes but weak	Yes
GS7- Constitutional rules	No	Yes
GS8- Monitoring & sanctioning	Weak	Yes
Resource Units (RU)		
RU1- Resource unit mobility	Mobile livestock	Stationary water points
RU2- Growth or replacement rate	With annual rain	With annual rain
RU3- Interaction among resource units	To limited degree	To limited degree
RU4- Economic value	Saving, insurance, status and income generation function of livestock;	Drinking water for human and livestock (see rangelands)
RU5- Size		
RU6- Distinctive markings	Yes	Yes
RU7- Spatial & temporal distribution	Stronger use pressure in good grazing areas	Dependent in groundwater level
Users (U)		
U1- Number of users	small	
U2- Socioeconomic attributes of users	Communal, often part-time farmers with moderate degree of subsistence orientation	
U3- History of use	Nomadism, colonial homeland policy	Traditional regulations, paternalistic government water supply
U4- Location	In resource system	Near resource system
U5- Leadership/entrepreneurship	Weak traditional authorities	Formalized community organisations & weak traditional authorities
U6- Norms/social capital	Generally High (but low related to grazing)	High
U7- Knowledge of SES/mental models	heterogeneous mental models	Relatively homogeneous perceptions
U8- Dependence on resource	High	High
U9- Technology used	None	Boreholes with wind, solar or engine pumps.
Interactions (I)		
I1- Harvesting levels of diverse users	High harvest level	Moderate harvest levels
I2- Information sharing among users	Informal	formalized
I3- Deliberation processes	Hardly	Monthly meeting
I4- Conflicts among users	Frequent conflicts and poor conflict resolution by traditional authorities	Conflict resolution moderately functioning
I5- Investment activities	No investment in good pasture	small to moderate repairs
I6- Lobbying activities	Lobbying for resettlement farms outside communal area and emergency relief	Lobbying for major repairs and new boreholes
Outcomes (O)		
O1- Social performance measures (e.g., efficiency, equity, accountability)	Considering poor ecological state moderate income generated and moderately distributed;	Efficient and equitable and transparent
O2- Ecological performance measures (e.g., overharvested, resilience, diversity)	Irreversibly overused with loss of species	Decreasing ground water level and water quality, impact of communal resource users unclear
O3- Externalities to other SESs	Soil erosion	No