Cooperation in the commons? Evidence from a cross-cultural field experiment on common-pool resource management

Sebastian Prediger (1), Bjørn Vollan and Markus Frölich (2)

(1) University of Marburg; Department of Economics; Institute for Co-operation in developing Countries; Am Plan 2, D-35037 Marburg, Germany.

(2) University of Mannheim; Department of Economics; Chair of Econometrics; L7,3-5, D-68131 Mannheim, Germany.

Source: Vollan
Common-pool resources

- Resources characterized by rivalry in consumption and costly exclusion of other users (e.g. pastures, water, community forests, biodiversity)

- **Proposition for many decades**: The conflict between individual and common interest will lead to resource degradation (Hardin, 1968)

- But Ostrom (Nobel prize 2009) has demonstrated that sustainable management of CPR is possible
  - Depending on (evolved) **norms of cooperation** shared by the resource users
  - ‘informal‘ rules (often unobserved by politicians)

- CBNRM initiatives partly base on these ideas
Research Questions

• Are norms of cooperation present in the study areas?

• Is there a cross-cultural difference between the Nama in Namibia and South Africa, as results from earlier experiments suggest?

• Are there rules (institutions) which can increase economic and ecological performance?

• What rules do resource users implement, and why?

• What makes people follow rules (not presented here)?
Subjects‘ economic background

Communal areas

- Both study areas mainly populated by the Nama people
- Small stock herding on subsistence level
- Livestock is kept on commonly used pastures
- High unemployment
- High pressure on resource base (risk of degradation)

Berseba in Namaland (NAM): 60 participants

Leliefontein in Namaqualand (RSA): 60 participants
Ecological Motivation: State and transition model

Vegetation ecological modeling

Transition probabilities depend on:
- Rainfall
- Stocking rate
- Breed

- Strong evidence that many parts of our study areas switched into a different ecological state

Domptail and Popp, unpublished
Experimental design of the Grazing Game

- 5 Players per session
- Each session lasts for 20 rounds (round = grazing season)
- Players choose one of two grazing areas [A or B] …
- … and chose the farming intensity [0, 1, or 2] in each round

The earnings depend on the chosen intensity AND the resource condition of the chosen location.

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>0</td>
</tr>
<tr>
<td>GOOD</td>
<td>0</td>
</tr>
<tr>
<td>BAD</td>
<td>0</td>
</tr>
</tbody>
</table>

- The grazing condition depends on the group intensity in the previous round: If group intensity >4 unit → Degradation!
Total intensity in B

Degradation (Group intensity > 4)

Recovery (intensity ≤ 1 for 2 consecutive rounds)

Total (group) intensity in A

Quality in A

Quality in B

• Group intensity determines grazing quality in next round
• Recovery is possible, but requires low group intensities (max. 1) for 2 successive rounds

Co-operation problem: Every player has an incentive to choose highest intensity which will lead to degradation and thus lower earnings
No rules (Rounds 1-10)

- Substantial difference between Namibia and RSA
- In RSA the groups got stuck into a situation where both grazing areas were bad
- In RSA, none of the groups could manage to recover back to HH
- In Namibia a higher share of the land is maintained in a good condition (42% vs 4% for RSA)
- RSA same results as in Thailand and Colombia

![Graph showing % of pastures in good condition over rounds for Namibia and South Africa]
• Analysis of behaviour under different resource scenarios reveals that Namibians have a much higher propensity to cooperate

• Namibians apply significantly lower grazing intensities in all scenarios

• Namibians are significantly less frequently faced with resource degradation

• The country difference remains highly significant if we consider socio-demographic variables in a multivariate regression analysis (not shown)

<table>
<thead>
<tr>
<th></th>
<th>Resource abundance</th>
<th>Spatial resource availability</th>
<th>Resource scarcity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Intensity</td>
<td>Obs</td>
<td>Mean Intensity</td>
</tr>
<tr>
<td>RSA</td>
<td>1.64</td>
<td>80</td>
<td>1.49</td>
</tr>
<tr>
<td>NAM</td>
<td>1.30</td>
<td>175</td>
<td>0.86</td>
</tr>
<tr>
<td>Difference</td>
<td>0.34</td>
<td>0.63</td>
<td>0.58</td>
</tr>
<tr>
<td>p-value</td>
<td>&gt;.000</td>
<td></td>
<td>&gt;.000</td>
</tr>
</tbody>
</table>
### Historical differences as explanation

Different historical developments in both areas

<table>
<thead>
<tr>
<th>Namaqualand (RSA):</th>
<th>Namaland (NAM):</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Colonization in 16th century</td>
<td>- Colonization in 1884</td>
</tr>
<tr>
<td>- Dispossession of land</td>
<td>- Nama Uprising</td>
</tr>
<tr>
<td>- Abandonment of traditional lifestyle</td>
<td>- Appropriation of their ancestral lands</td>
</tr>
<tr>
<td>- Strong western influence:</td>
<td>- Only the Nama tribe in our study area could preserve its territory</td>
</tr>
<tr>
<td>- circulation of money</td>
<td>- Could retain local institutions largely intact</td>
</tr>
<tr>
<td>- adoption of Afrikaans</td>
<td>- Managed by captaincy until independence</td>
</tr>
<tr>
<td>- Maladministration and corruption</td>
<td></td>
</tr>
<tr>
<td>- ’Economic units’ (Privatization)</td>
<td></td>
</tr>
</tbody>
</table>

The relative strong western influence, corruption and the attempt to privatize the commons may have eroded norms of co-operation in RSA.
The Rules tested

After round 10 a 'community meeting' was held, players could choose one from 3 different rules which had to be implemented for the last 10 rounds

• **Rotation rule**: Each round one location is banned from grazing: A in rounds 11 and 12, B in rounds 13 and 14 etc. If a participant is caught grazing illegally the points need to be returned.

• **Regulation rule**: The individual grazing intensity is limited to 1 unit per round. In case a participant is caught putting an intensity of two, the participant need to pay back the points.

• **Lottery rule**: Random determination of the location where each player has to graze in each round. When a participant graze in a location illegally, a throw of a six of the dice leads to paying back the points.
Voting Results (rule choice)

- Rotation is the preferred rule among all players.

- No difference whether farmer or not or being from Namibia or South Africa.

- Rotation is perceived as the ‘fairest’ and most ‘efficient’ rule.

- Rotation is seen as the rule which advances ‘self interest’ best by the players.
Rule Efficiency

- Compared to Lottery, Rotation and Regulation significantly increase the number of good grazing areas available to the group.

<table>
<thead>
<tr>
<th>Number good grazing</th>
<th>Pooled</th>
<th>South Africa</th>
<th>Namibia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lottery</td>
<td>-0.486</td>
<td>-0.018</td>
<td>-0.943**</td>
</tr>
<tr>
<td></td>
<td>(0.340)</td>
<td>(0.331)</td>
<td>(0.442)</td>
</tr>
<tr>
<td>Rotation</td>
<td>-0.343</td>
<td>0.620**</td>
<td>-0.965**</td>
</tr>
<tr>
<td></td>
<td>(0.328)</td>
<td>(0.311)</td>
<td>(0.377)</td>
</tr>
<tr>
<td>Regulation</td>
<td>0.427</td>
<td>1.420***</td>
<td>-0.147</td>
</tr>
<tr>
<td></td>
<td>(0.358)</td>
<td>(0.287)</td>
<td>(0.363)</td>
</tr>
</tbody>
</table>

- Cumulated until last round

| lag_group_mean_earn_cum   | -0.013* | -0.017 | -0.019* |
|                          | (0.007) | (0.013) | (0.010) |
| lag_stdev_earn_cum       | -0.013  | 0.003  | -0.009  |
|                          | (0.009) | (0.014) | (0.009) |

<table>
<thead>
<tr>
<th>Last round</th>
</tr>
</thead>
<tbody>
<tr>
<td>lag_ord_graz_cat_h</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>lag_ord_graz_cat_l</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Round</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>round_20</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Comparison to the first 10 rounds:

- Strong country difference!

- In South Africa Rotation and Regulation increase number of good grazing.

- In contrast to Namibia, where none of the rules increased grazing availability.

- Crowding out effect of intrinsic motivation to cooperate in Namibia.
Summary

- Namibians reveal a much higher propensity to cooperate than their relatives from South Africa (due to historical differences)

- Our results provide evidence that social norms of cooperation are relatively strong in Namibia (but challenges)

- The majority of participants from both countries prefer the Rotation rule which is also recommended by extension officers

- Rotation is perceived as the rule which is most efficient, fairest and most likely to advance self-interest

- The implementation of rules, especially of Rotation and Regulation increases earnings and the grazing conditions in South Africa significantly (but negative effect in Namibia)

- Rule breaking can be substantially reduced if people are monitored regularly
Thank you very much for your attention!
Ecological differences as explanation

- **Leliefontain in Namaqualand (RSA):**
  - Succulent Karoo
  - Biodiversity hotspot
  - Av. rainfall 150-400 mm
  - Rains relatively predictable
  - Droughts occur only seldomly

- **Namaland (NAM):**
  -Nama Karoo
  - Av. rainfall 50-200mm
  - Rainfall unpredictable, spatially variable and highly erratic
  - More responsive to grazing
  - Severe droughts are common

Namibians may have a good ecological knowledge and know that heavy overgrazing can make pastures useless for many years.
Overview of the talk

• Cultural and ecological background

• Experimental design

• Experimental Results
  • Cross-cultural comparison
  • Rule choice, efficiency and rule following behaviour

• Summary and Conclusion
• **HH-survey 2004**: 65% agree, that “I would get more money from farming if I and everybody else would reduce the amount of animals.

• More than 50% of communal farmers believe it is possible to practice **rotational grazing** in communal areas. Almost 40% see **co-operation** between farmers as main problem.