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LETTER

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Limited open access in socioecological systems: How do communities deal with environmental unpredictability?

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Abstract

Classical theory on the commons holds that rules are fundamental to sustainability. However, open access may be present in many sustainable socioecological systems. Here, we explore the interaction between environmental unpredictability and cooperation in a fishery in the Pantanal wetland, Brazil. We show that a variable annual flood pulse combined with channel blockages results in a high turnover in fishing grounds. To counter this variability, fishers openly share information about fishing areas with all community members, but are highly territorial with neighboring communities. We argue that this open access within communities but common property between communities represents a system of limited open access and, using a mathematical model, suggest that such a system is favored under conditions of moderate competition and high levels of resource unpredictability. Failing to take into account the social norms that underpin limited open access systems may undermine conservation interventions.

KEYWORDS

common property regime, customary practices, fisheries, freshwaters, information sharing, management of natural resources, the Pantanal, unpredictability

1 | INTRODUCTION

Conservation interventions that are not in tune with local livelihoods may not only jeopardize the well-being of local people (Milner-Gulland et al., 2014) but also exacerbate impacts on the environment (Adams & Hutton 2007). Classical theory on the commons holds that the most effective management strategy for assuring sustainability in socioecological systems is to guarantee that a set of institutional arrangements (or rules) are present, such as well-defined boundaries, cost sharing, and formal sanctions (Ostrom, 2011; Vollan & Ostrom 2010). Where these conditions are met, people weighing up the costs and benefits of maximizing the use of natural resources could reach sustainability (Vollan & Ostrom 2010). Following this, many conservation interventions focusing on the establishment of strong institutional arrangements have brought great improvement (Schnegg, 2018). For example, the introduction of clear resource use boundaries and the sanctioning of rule violators in the Mamirauá reserve (Amazon floodplain) led to a nine-fold increase in the population of arapaima species and a 10-fold increase in local catch (Campos-Silva & Peres 2016; Castello, Viana, Watkins, Pinedo-Vasquez, & Luzadis, 2009).

Recently, however, scholars have been challenging the dichotomy between "rules" (property regimes) leading to sustainability and "no rules" (open access) leading to a tragedy of the commons, as presented in the classical theory on the commons (Behnke, Robinson, & Milner-Gulland, 2016). Open access may be present in many socioecological systems, especially in those areas facing seasonal changes such as concentrated rainfall and flood pulses (Moritz, Scholte, Hamilton, & Kari, 2013). According to Moritz, Hamilton, Scholte, and Chen (2014), the unpredictable distribution of resources in such systems often leads users to have extensive harvesting areas, allocating themselves in an ideal free distribution with weak boundaries between people and the resources they use, or no boundaries at all (Behnke et al., 2016). Such a system has been described as an Open Property Regime. Where this is the case, imposing top-down institutional arrangements, such as defined boundaries of resource use may be counter-productive, limiting the mobility of users and hindering their ability to track the spatiotemporal distribution of resources, jeopardizing livelihoods (Adams & Hutton 2007; Moritz et al., 2014). However, our understanding of the factors that promote open access versus territoriality in communities living in unpredictable environments is underdeveloped, and the question remains as to whether open access and common property regimes can coexist (Schnegg, 2018).

Understanding how "bottom-up" systems of resource management emerge requires an appreciation of the dynamics of cooperation and competition within and between groups. For individuals, there is an incentive to "free ride" by taking more from a public resource than is contributed or by extracting resources unsustainably, as in the classic tragedy of the commons (Hardin, 1968). The problem of free riding can potentially be solved by within group processes such as third-party punishment, policing, reputation, and conditional reciprocity (Nowak, 2006; Ostrom, 1990; West, Griffin, & Gardner, 2007). However, it is also possible that intense competition between cultural groups may promote within-group cooperation (García & van den Bergh 2011; Traulsen & Nowak 2006; Waring & Acheson 2018).

This article focuses on a salient but little studied freshwater fishery in the 160,000 km^2 Pantanal wetland, western Brazil. For many years, conservation interventions attempted to tackle alleged overfishing in this region by restricting the use of fishing gears, imposing fishing quotas, closing fishing grounds, and displacing local people (Chiaravalloti, 2017a). Using the Pantanal wetland as a case study, we show that the unpredictable nature of the Pantanal restricts fishers from using most of the floodplain, allowing ecological sustainability without need for social rules, formal or informal sanctions. This ecological dynamic, combined with the social organization of local people, promotes a behavior of limited open access, in which fishers openly share territory and information about the location of fish within their communities but restrict the access of fishers from other communities. Based on a simple mathematical model, we suggest that limited open access is favorable when there are moderate levels of competition for resources and low predictability in resource distribution.

2 | METHODS

2.1 The Pantanal and the flood pulse

The Pantanal wetland annual flood pulse takes between 3 and 4 months to pass through (Junk et al., 2006). The timing, duration, and extent of the flood differs greatly from year to year (Hamilton, Sippel, & Melack, 1996). Fishing in the Pantanal is focused on large fish and on bait (either small fish or crabs) and represents over 90% of the local income (ECOA, 2013). Due to variability in the flood pulse location, different populations of the same species of crab and fish migrate and reach their peak abundance at different times (Resende, 2011).

This research was focused on the Western Border of the Pantanal, a region in which around 600 people within 70 families live, clustered in three main settlements. Settlement 1, the main focus of this study, has a population of 97 people living in 23 households, grouped into three extended families. This study focuses on the 33,651 ha used by fishers from Settlement 1 (Chiaravalloti, 2017a).

2.2 Data collection

2.2.1 Availability of fishing grounds

In order to understand the availability of fishing grounds, we used two sets of six scenes of Brazilian Rapid Eye satellite images (5-meter resolution, 2011 and 2014) to classify all water bodies that could be used as fishing grounds within Settlement 1′s region. We considered only water bodies larger than 0.5 ha to be viable fishing grounds. This fine scale allowed us to verify whether each of the water bodies classified were connected to the main river or not. Water bodies commonly lose connection to the main river when floating mats of vegetation get stuck in river channels or bay mouths, closing them off or, more occasionally, when river channels themselves change (Assine et al., 2015). Since outboard powered canoes cannot cross vegetation blockages, a blocked water body cannot be used for fishing.

2.2.2 Customary practices

Three years of qualitative ethnographic data collection were undertaken in the Western Border of the Pantanal, especially in Settlement 1 (in 2014, 2015, and 2017). We undertook participant observation and semistructured interviews using printed maps in order to gain a better understanding of the patterns of access and cooperation, and how people see control of resources and sharing. In total, 80 people were interviewed, 60 from Settlement 1.

3 | RESULTS

The territory of fishers from Settlement 1 contains 464 water bodies, encompassing 14,639 ha of water. In 2011, 75.2% of all water bodies were inaccessible (349), although this only represented 16.17% (2,367.41 ha) of the total area of water. In 2014, the number of closed water bodies increased to 79.5%

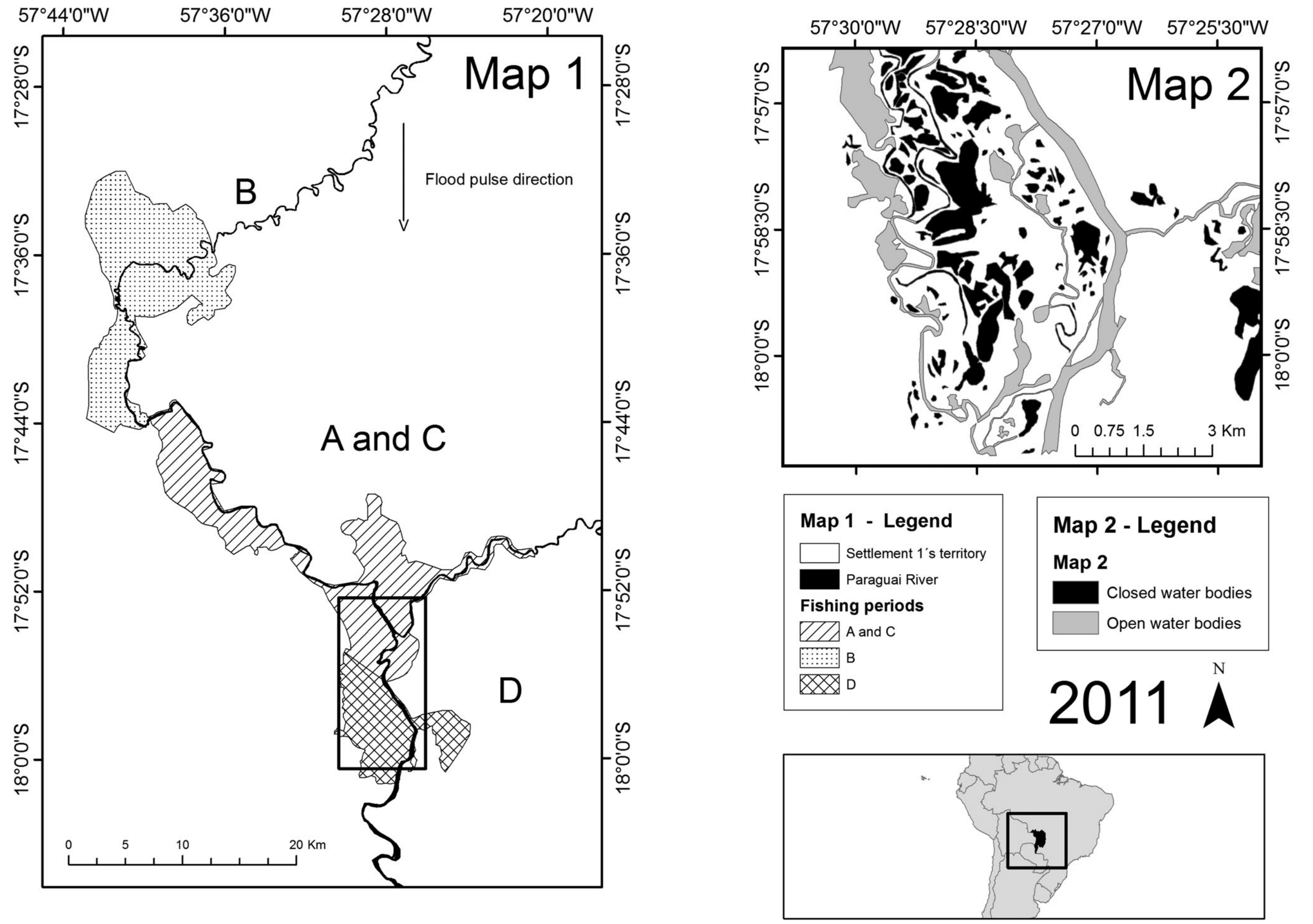

FIGURE 1 Map 1: Fishing effort in the four regions (A, B, C, and D). Map 2: Highlights the availability of water bodies in part of the region D (data for 2011)

(369), representing 22.99% of all water areas (Supporting Information Table S1) (Figure 1).

Since fish and crab reproduction is related to the flood pulse, variation in the timing and extent of the flood pulse also creates temporal variability in fish stocks. This means that fishers need not only to locate accessible water bodies but water bodies that contain fish at that particular time. Thus, both the accessibility of water bodies and spatial variation in the flood wave drive variability in the distribution of viable fishing grounds. Considering both drivers, the percentage of available areas is drastically reduced (Figure 2). Given that the unpredictable nature of the flood pulse and the changes in vegetation blockages (Supporting Information Table S2) effectively "reset" the system each year, the knowledge fishers gain about the accessibility and economic viability of water bodies in one year is rarely of use in the following year.

Fishers from Settlement 1 openly share information about the location of productive fishing pools with everyone in the community, regardless of family ties. The information about productive fishing or gathering spots typically occurs during several ice tea drinking sessions held each day ("tereré"), in which people from the different extended families participate. Although some people complained that not every-

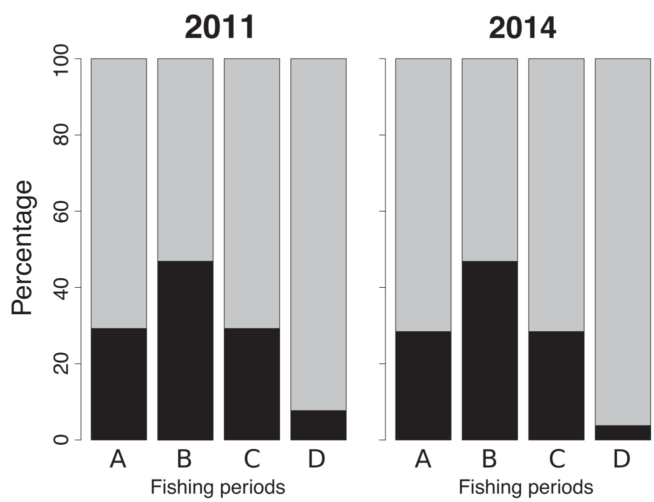

FIGURE 2 Proportion of fishing areas that were accessible (black) and inaccessible (grey) in 2011 and 2014 in periods A, B, C, and D

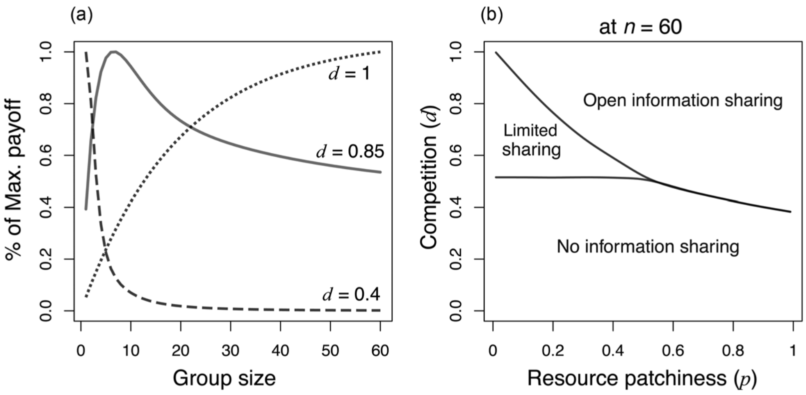

FIGURE 3 (a) Shows the relationship between group size and maximum payoff under three different competition levels. (b) Shows the relationship between competition and resource patchiness and the predicted outcome of the different combinations of the two parameters

one tells the truth, we regularly saw fishers visiting other people's houses in order to verify catches and to establish trust regarding the information that they had been given. This open system of information sharing appears to occur without any kind of clear punishment being recorded in the rare cases where people were not truthful about productive fishing spots.

In general, the system works in the following way: some people go to fish in a specific location and others look for new ones. If someone manages to find a more productive fishing location, they will inform the others, and everyone moves there. This method is repeated throughout the fishing season. Because the flood pulse keeps moving from north to south, people have to regularly move their fishing sites and find new fishing spots. They will rarely stay at the same fishing site for more than a week. Throughout the year this process creates a rotational fishing system.

Critically, the open cooperation and reciprocity shown by people from Settlement 1 toward other members of their community does not extend to people from outside their community. They neither shared information with nor allowed people from other settlements to use water bodies located inside their group's territory. Two cases of forced sanctions were reported regarding outsiders trying to move in to Settlement 1′s area of use. Although less well-studied, people from Settlement 2 and Settlement 3 had a similar notion of territory and reciprocity among community members. This suggests a system of limited open access, whereby information and territory are freely shared with members of the community but not with those from neighboring communities, who are actively excluded.

In order to understand the conditions under which a system of limited open access would be favored, we created a mathematical model. The model considers a population of n individuals extracting resources from an environment composed of discrete locations that either contain resources or contain no resources. The parameter P determines the probability that a randomly chosen location contains recourses. In the case of the Pantanal, P represents the proportion of fishing pools containing fish that are accessible to fishers. The probability of a lone individual successfully harvesting resources from a randomly selected pool is therefore P. Where individuals go to separate locations and then share information about the location of resources, they have a greater chance of finding something. In fact, large groups may successfully find several locations containing resources. To generalize, the probability of a group of n individuals finding i locations containing resource is:

$$\binom{n}{i} \; P^i \, (1-P)^{n-i}. \tag{1}$$

Thus, by sharing information in larger groups, individuals increase their likelihood of successfully locating a resource. This group benefit is particularly pronounced when P is low (i.e., when resources are difficult to find).

However, by sharing information about the location of resources, individuals may increase competition between individuals for resources. In the model, the degree of competition is determined by parameter d. The resources that an individual extracts from a location are defined as:

$$d^{\left(\frac{n}{i}-1\right)}, \tag{2}$$

where n is the total population and i is the number of resource containing locations available to the population. Combining Equations (1) and (2), we can define the expected payoff of an individual sharing information about resource location in a group of n agents as:

$$\sum_{i=1}^{n} \binom{n}{i} P^i \, (1-P)^{n-i} \, d^{\left(\frac{n}{i}-1\right)}.$$

Varying only d and P, we can find three different kinds of payoff curves associated with group living. Figure 3a shows these three kinds of payoffs at three different levels of d at $P = 0.03$. When there is no competition associated with sharing a location (i.e., when $d = 1$, dotted line in Figure 3a), each additional group member increases the expected payoff of all group members. Such conditions would favor a completely open system in which information is shared among all group members. In contrast, if competition between individuals is very high ($d = 0.4$, dashed line), the maximum payoff is to act alone and to never share information with others. However, for intermediate values of d, such as at $d = 0.85$ (solid line), there is an optimum group size and, as such, the best strategy is to share information with only a subset of the population. We characterize this as a system of limited open access, and suggest that such a system is favored by moderate competition and unpredictable resource distribution, as seen in the case of the Pantanal described above.

4 | DISCUSSION

Many conservation interventions are focused on guaranteeing ecological sustainability regardless of the social consequences (Milner-Gulland et al., 2014). The fishers of the Pantanal described here have been facing strict top-down measures in order to tackle a supposed overfishing, jeopardizing livelihoods (Chiaravalloti, 2016). However, we have shown that restrictions imposed by the system itself on the use of economically viable fishing grounds limit fishing to less than 10% of all available water bodies for much of the year. Although the unpredictability of this system creates environmental limits that hinder the possible overexploitation of fish (Chiaravalloti, Homewood, & Erikson, 2017; Welcomme & Hagborg 1977), cultural values, alternative livelihoods, a low population density, and the use of relatively simple technology may also contribute in safeguarding the fish stocks. Indeed, studies in the Pantanal have shown no signs of overfishing (Mateus, Vaz, & Catella, 2011). Local sustainability may be achieved simply by respecting this ecological dynamic.

We suggest that, for Pantanal fishers, openly sharing information about productive fishing spots with community members while restricting it from outsiders may allow individuals to optimize their fishing return rates. While within groups we see a system of open access and between groups we see a classical common property regime (Ostrom, 2011). We characterize the combination of these two regimes as a system of limited open access. Such a system has also been described elsewhere. For example, Behnke et al. (2016) showed that open access and common property regimes work together among pastoralists in Turkmenistan. Similarly, Beitl (2015) shows that a community of cockle fishers in Ecuador shares an ethos of open access among themselves but quickly display a sense of territory and shared property when their area is threatened by shrimp farmers.

We argue that the system of limited open access that we see in the Pantanal is the result of within-group cooperation and between-group competition for patchily distributed resources. Although our mathematical model assumes that agents cooperate within groups to share information about resource distribution, in reality cooperation is the product of the complex social dynamics that may operate at the level of the individual (i.e., reciprocity, reputation, punishment, or ostracism) or may be a product of competition between groups (García & van den Bergh 2011; Traulsen & Nowak 2006; Waring et al., 2015). Theoretical work has suggested that within-group cooperation and between-group exclusion may be causally linked, with cultural institutions relating to resource conservation within groups being favored by between-group competition (Waring et al., 2015), a theory that has been advanced to explain the emergence of territorial lobstering in Maine (Waring & Acheson 2018). Further ethnographic research in the Pantanal is required to better understand the processes by which within-group cooperation is maintained.

The role of cooperation, competition, and resource distribution in shaping human social organization has been discussed by human behavioral ecologists for some time. For example, Dyson-Hudson and Smith (1978) present a model about the presence of territoriality under different levels of resource abundance and unpredictability, suggesting that the presence of territorial strategy depends on the cost-benefit ratio of defending resources, with unpredictability favoring weak boundaries (Fernández-Giménez, 2002). Supporting this, Berge (1997) showed that in Saharan rangelands, the harsh climate restricts the use of resources by Tuareg pastoralists', favoring an open access system. The opposite is also true, with clearer boundaries appearing with more a predictable and dense distribution of resources (Ostrom, 2011). Limited open access also has parallels with the flexible land access and food sharing described for small-scale hunter-gatherer societies (Bliege Bird, Codding, & Bird, 2016; Dyble et al. 2016; Dyson-Hudson & Smith 1978; Winterhalder, 1996).

5 | CONCLUSION

The emergence of "bottom-up" rules governing resource use is shaped by a range of historic, economic, ecological, and anthropological factors such as historical enforcement, and physical and economic displacement (Behnke et al., 2016; Chiaravalloti et al., 2017). Therefore, parameters, such as group size, levels of sharing and sanctions toward community members and outsiders may vary according to marks imprinted in de facto resource use patterns. However, through our ethnography and mathematical modeling, we suggest that socioecological systems under similar conditions to the Western Border of the Pantanal (high unpredictability and moderate competition) may neither work as an open property regime (Moritz, 2016) nor as a classic common property resource management regime (Vollan & Ostrom 2010), but can work as a limited open access regime. Where such regimes exist, conservation interventions should take them into account in order to support local livelihoods. In terms of policy, this could be achieved by the creation of flexibly bounded protected areas that allow access according to different tenure rights

(Chiaravalloti, 2017b). Within the Brazilian legislation this could be done through the creation of sustainable development protected areas that partly fulfill these requirements.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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REFERENCES

Adams, W. M., & Hutton, J. (2007). People, parks and poverty: Political ecology and biodiversity conservation. *Conservation and Society*, *5*, 147-183.

Assine, M. M. L., Macedo, H. A. H., Stevaux, J. J. C., Bergier, I., Padovani, C. R., & Silva, A. (2015). Avulsive rivers in the hydrology of the Pantanal wetland. In I. Bergier & M. L. Assine (Eds.). *Dynamics of Pantanal wetland. South America* (pp. 83-110). New York City, NY: Springer.

Behnke, R., Robinson, S., & Milner-Gulland, E. J. (2016). Governing open access: Livestock distributions and institutional control in the Karakum Desert of Turkmenistan. *Land Use Policy*, *52*, 103-119.

Beitl, C. M. (2015). Mobility in the mangroves: Catch rates, daily decisions, and dynamics of artisanal fishing in a coastal commons. *Applied Geography*, *59*, 98-106.

Berge, G. (1997). *Open Access without tragedy of the commons: The case of Rangelands in Adrar of the Ifoghas in Northern Mali* (No. 6). SUM Working Paper, Oslo, Norway.

Bliege Bird, R., Codding, B., & Bird, D. (2016). Economic, social and ecological benefits of hunting, sharing and fire in the western desert of Australia. In B. F. Codding & K. Kramer (Eds.). *21st Century hunter gatherer*. Santa Fe, NM: SAR Press.

Campos-Silva, J. V., & Peres, C. A. (2016). Community-based management induces rapid recovery of a high-value tropical freshwater fishery. *Scientific Reports*, *6*, 1-13.

Castello, L., Viana, J. P., Watkins, G., Pinedo-Vasquez, M., & Luzadis, V. A. (2009). Lessons from integrating fishers of arapaima in small-scale fisheries management at the mamirauá reserve, amazon. *Environmental Management*, *43*, 197-209.

Chiaravalloti, R. M. (2016). Is the Pantanal a Pristine place? Conflicts related to the conservation of the Pantanal. *Ambiente & Sociedade*, *19*, 305-310.

Chiaravalloti, R. M. (2017a). Overfishing or over reacting? Management of fisheries in the Pantanal wetland, Brazil. *Conservation & Society*, *15*, 111-122.

Chiaravalloti, R. M. (2017b). Systematic conservation planning in floodplain fisheries: To what extent are fishers' needs captured in prioritisation models? *Fisheries Management and Ecology*, *24*, 392-402.

Chiaravalloti, R. M., Homewood, K., & Erikson, K. (2017). Sustainability and land tenure: Who owns the floodplain in the Pantanal, Brazil? *Land Use Policy*, *64*, 511-524.

Dyble, M., Thompson, J., Smith, D., Salali, G. D., Chaudhary, N., Page, A. E., ... Migliano, A. B. (2016). Networks of food sharing reveal the functional significance of multilevel sociality in two hunter-gatherer groups. *Current Biology*, *26*, 2017-2021.

Dyson-Hudson, R., & Smith, E. A. (1978). Human teritoriality: An ecological reassessment. *American Anthropologist*, *80*, 21–41.

ECOA. (2013). *Ações para o turismo de base comunitária na contenção da degradação do Pantanal*. Campo Grande, Brazil: ECOA.

Fernández-Giménez, M. E. (2002). Spatial and social boundaries and the paradox od pastoral land tenure: A case study from postsocialist Mongolia. *Human Ecology*, *30*, 49-78.

García, J., & van den Bergh, J. (2011). Evolution of parochial altruism by multilevel selection. *Evolution and Human Behavior*, *32*, 277-287.

Hamilton, S. K., Sippel, S. J., & Melack, J. M. (1996). Inundation patterns in the Pantanal wetland of South America determined from passive microwave remote sensing. *Archiv fur Hydrobiologie*, *137*, 1-23.

Hardin, J. G. (1968). The tragedy of the commons. *Science 162*, 1243-1248.

Junk, W. J., Da Cunha, C. N., Wantzen, K. M., Petermann, P., Strüssmann, C., Marques, M. I., & Adis, J. (2006). Biodiversity and its conservation in the Pantanal of Mato Grosso, Brazil. *Aquatic Sciences*, *68*, 278-309.

Mateus, L., Vaz, M., & Catella, A. (2011). Fishery and fishing resources in the Pantanal. In W. J. Junk, C. J. Da. Silva, C. N. Cunha, & K. M. Wantzen (Eds.). *The Pantanal: ecology, biodiversity and sustainable management of a large neotropical seasonal wetland* (pp. 621–647). Sofia-Moscow, Bulgaria: Pensoft.

Milner-Gulland, E. J., Mcgregor, J. A., Agarwala, M., Atkinson, G., Bevan, P., Clements, T., ... Wilkie, D. (2014). Accounting for the impact of conservation on human well-being. *Conservation Biology*, *28*, 1160-1166.

Moritz, M. (2016). Open property regimes. *International Journal of Commons*, *10*, 688-708.

Moritz, M., Hamilton, I. M., Scholte, P., & Chen, Y.-J. (2014). Ideal free distributions of mobile pastoralists in multiple seasonal grazing areas. *Rangeland Ecology and Management*, *67*, 641-649.

Moritz, M., Scholte, P., Hamilton, I. M., & Kari, S. (2013). Open access, open systems: Pastoral management of common-pool resources in the Chad basin. *Human Ecology*, *41*, 351-365.

Nowak, M. A. (2006). Five rules for the evolution of cooperation. *Science*, *314*, 1560-1563.

Ostrom, E. (1990). *Governing the commons*. Cambridge, England: Cambridge University Press.

Ostrom, E. (2011). Background on the institutional analysis and development framework. *Policy Studies Journal*, *39*, 7-27.

Resende, E. (2011). Ecology of fish. In W. J. Junk, C. J. D. A. Silva, C. N. da Cunha, & M. W. Karl (Eds.). *The Pantanal: Ecology, Biodiversity and Sustainable Management of a Large Neotropical Seasonal Wetland* (pp. 469-523). Sofia-Moscow, Bulgaria: Pensoft.

Schnegg, M. (2018). Institutional multiplexity : Social networks and community-based natural resource management. *Sustainability Science*, *13*(4), 1017-1030.

Traulsen, A., & Nowak, M. (2006). Evolution of cooperation by multilevel selection. *Proceedings of the National Academy of Sciences*, *103*, 10952-10955.

Vollan, B., & Ostrom, E. (2010). Cooperation and the commons. *Science*, *330*, 923-924.

Waring, T., & Acheson, J. (2018). Evidence of cultural group selection in territorial lobstering in Maine. *Sustainability Science*, *13*, 21-34.

Waring, T. M., Kline, M. A., Brooks, J. S., Goff, S. H., Gowdy, J., Janssen, M. A., ... Jacquet, J. (2015). A multilevel evolutionary framework for sustainability analysis. *Ecology and Society*, *20*, 1-17.

Welcomme, R. L., & Hagborg, D. (1977). Towards a model of a floodplain fish population and its fishery. *Environmental Biology of Fishes*, *2*, 7-24.

West, S. S. A., Griffin, A. S., & Gardner, A. (2007). Evolutionary explanations for cooperation. *Current Biology*, *17*, R661-R672.

Winterhalder, B. (1996). A marginal model of tolerated theft. *Ethology and Sociobiology*, *17*, 37-53.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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