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Community spatial distance and educational determinants of how local people appreciate conservation benefits around Tarangire and Saadani National Parks, Tanzania



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ABSTRACT

The understanding of how educational and spatial factors influence appreciation of conservation benefits to locals living adjacent to protected areas is a very important aspect in conservation initiatives. In this study we compared how educational and spatial factors affect the appreciation of conservation benefits to local communities adjoining the two Tanzanian national parks; Tarangire National Park (TNP) and Saadani National Park (SANAPA). Questionnaire surveys including closed-ended questions were conducted in eight villages, four near each of the two parks. A total of 400 randomly selected households were interviewed (50 in each village). Results from these questionnaires showed that the local people's appreciation of benefits was negatively related to increasing distance from the parks boundaries. Moreover, people with secondary education or higher, appreciated to receive more benefits than those with primary and tended to appreciate benefits more often than those with no formal education. In addition, people living around TNP responded that the park itself benefited more in terms of benefits from tourism compared to communities surrounding SANAPA. The underlying mechanisms for establishing strong relationships, e.g., by initiating conservation benefits close to national parks, is key to improve views on conservation practices from local people surrounding national parks.

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1. Introduction

In the developing world, natural resource dependency is high and local communities attached to protected areas (PAs) earn a high share of their living from such resources (Abukari and Mwalyosi, 2020; Baral and Heinen, 2007; Galvin et al., 2020; Kyando et al., 2019; Molina Murillo et al., 2016). When local communities receive benefits related to conservation activities, their interests and commitment to be active in conservation initiatives will be facilitated (Andrade and Rhodes, 2012; Kidegesho, 2008; Lobora, 2016; Mashauri, 2017; Molina Murillo et al., 2016). Conservation benefits received by local communities due to the presence of PAs, normally shape their behavior to be more responsible for conservation activities (Ansong and Røskft, 2011;

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Infield and Namara, 2001; Mfunda and Røskaft, 2011; Molina Murillo et al., 2016), which again shape their behavior to appreciate even more benefits associated with PAs (Andrade and Rhodes, 2012; Infield and Namara, 2001; Lobora, 2016; Mashauri, 2017; Molina Murillo et al., 2016). Conservation benefits are part of the incentives that most PA authorities offer to the adjoining communities who suffer by conservation costs such as fears towards wild animals, crop raiding, livestock depredation and even human attacks and/or kills (Andrade and Rhodes, 2012; Colchester, 2004; Kidegesho, 2008; Mbise et al., 2018; Newmark and Hough, 2000).

Benefits usually compensate for costs associated with living close to PAs (Molina Murillo et al., 2016; Nepal and Spiteri, 2011; Scherl et al., 2006). Therefore, understanding why some measures deployed by different PA authorities are being appreciated by adjoining communities is of paramount importance in conservation (Abukari and Mwalyosi, 2020; Andrade and Rhodes, 2012; Molina Murillo et al., 2016), because a good relationship between local communities and PA authorities accelerates conservation initiatives (Kidegesho, 2008; Lobora, 2016; Mashauri, 2017) and addresses the needs of the surrounding communities (Lele et al., 2010; Molina Murillo et al., 2016; Nana and Tchamadeu, 2014). Improved relationships between local communities and PA authorities reduce conservation costs, such as costs related to protection against poachers (Kidegesho, 2008; Lele et al., 2010; Nelson and Makko, 2005).

Local communities have since memorial times lived inside and around areas that are now protected (Andrade and Rhodes, 2012; Kyando et al., 2019; Molina Murillo et al., 2016; Nepal and Spiteri, 2011). When local communities appreciate benefits from PA authorities they are often willing to report poachers and/or contribute with good ideas about how to improve conservation initiatives about their local environment (Abukari and Mwalyosi, 2020; Aronson and Figueroa Benavides, 2006; Dickman, 2010; Eboa et al., 2011; Mavah et al., 2018). Therefore it is important to understand that local communities living adjacent to protected areas play an important role in ensuring the success of conservation initiatives (Allendorf, 2020; De Boer and Baquete, 1998; Molina Murillo et al., 2016; Nelson and Makko, 2005). Moreover, these conservation initiatives often become successful when local communities are completely involved and when they receive benefits (Allendorf, 2020; Galvin et al., 2020; Kidegesho, 2008; Molina Murillo et al., 2016; Sekhar, 2003). In this study, conservation benefits are benefits which nearby communities receive as a support from the conservation authorities. These benefits are intended to compensate for conservation costs such as fear, crop raiding, livestock depredation and even human attacks. Examples of conservation benefits are new schools, teachers' facilities, school furnishings, youth centers, libraries, support of children's rights, dispensaries, water projects, roads, and many more.

In this study we assessed how demographic, spatial, educational, and socio-economic factors influence how local communities adjoining two national parks in Tanzania appreciate conservation benefits provided by the park. With appreciation in this study is referred to as how much the local people are satisfied with conservation benefits provided by parks authorities to enhance the relationship between the two. We focused mainly on two research questions; what underlying factors are associated with (1) how people appreciate the social-economic benefits received by living next to a National Park, and (2) the impression that tourism income generated from the National Park benefit local people in the village more than the park itself.

2. Methods

2.1. Study area

Tarangire National Park (TNP) and Saadani National Park (SANAPA) (Fig. 1) are located in the northern part and eastern-coastal part of Tanzania, respectively.

2.2. Data collection and analysis

From May to August 2015 we collected data using a questionnaire survey with closed-ended questions. Data on demographic characteristics, economic and educational information, along with their views on benefits appreciation were collected in the survey; I. Park identity, II. Village distance from the park (km), III. Age group, IV. Gender, V. Economic activity (community type of activity that earns their living), and VI. Level of education (Table 1).

Eight villages were selected for this study based on their proximity to one of the respective parks, four from TNP (Nkaiti-3 km, Olasiti-6 km, Mwikantsi-7 km, and Kwaraa-9 km) and four from SANAPA (Matipwili-2 km, Saadani-3 km, Mkwaja-4 km, and Gonggo-5 km). Respondents (above 18 years) were randomly selected from each village. Because a complete sample of all households was not feasible, we selected 50 households from each village, constituting more than 10% of each village population. By respecting the norms and culture of all visited villages, we ended with more males being interviewed than females. In many tribes in Tanzania, men have the right to speak to the public as they are regarded to have more views and opinions than the opposite sex because women normally stay home caring for the family. The responses regarding appreciation in the questionnaire had a binomial response (yes/no).

2.3. Statistical analyses

We used χ^2 -tests to assess whether there were any differences in the distribution of appreciation between groups, and we used a generalized linear model to examine the effect of village distance from the park boundary (Table S1). Thereafter, we assessed the relative importance of these factors in a joint model combining all variables, accounting for random variation

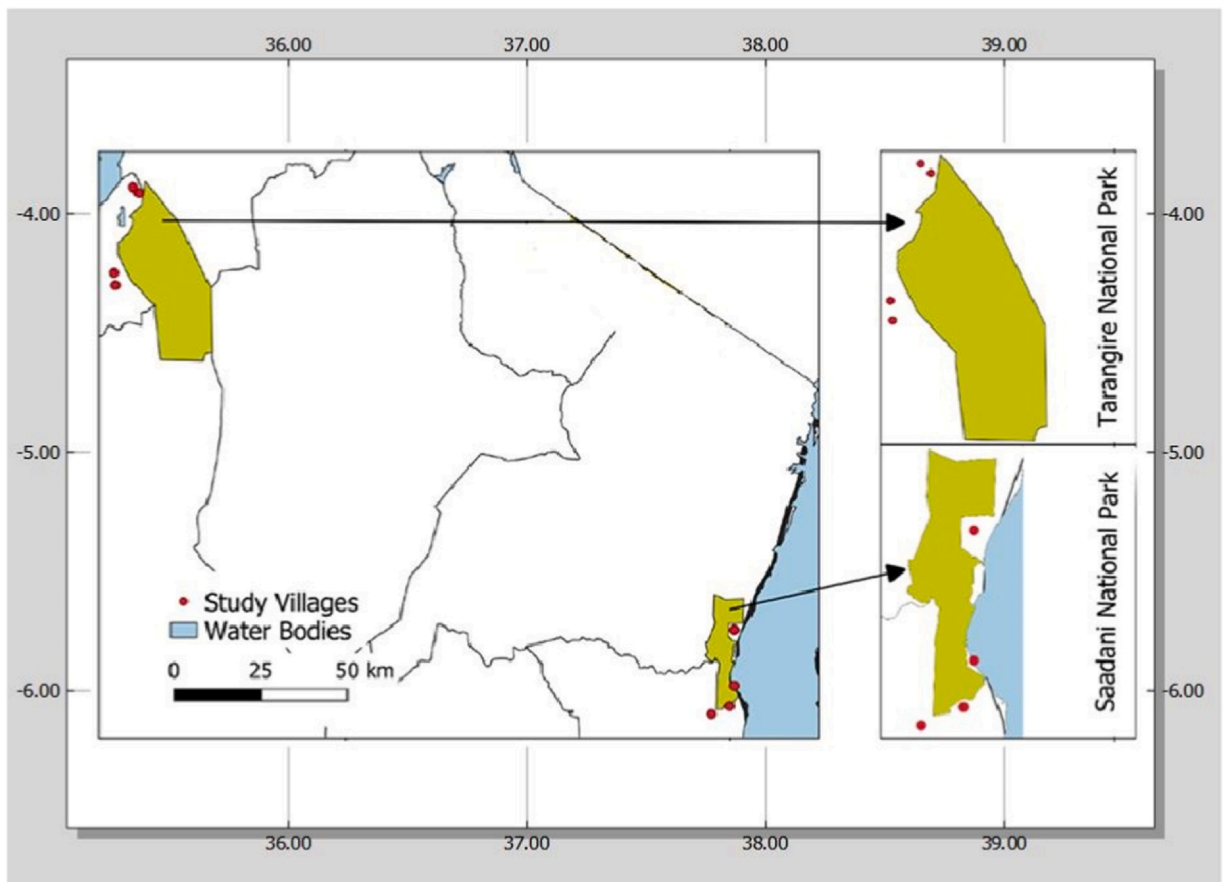


Fig. 1. Map of northern Tanzania, showing the two examined national parks in green; Tarangire (upper left corner) and Saadani (lower right corner) with adjoining study villages (red dots). The four villages were selected based on their different distance from each national park. We obtained information regarding whether local people appreciated conservation benefits generated from the parks, and the perceived share of benefits between parks and local people in eight villages using questionnaires in 2015. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Table 1

Overview of demographic and socio-economic characteristics of respondents ($n = 400$) of questionnaires assessing benefit appreciation from national parks and whether such benefits are shared between parks and local people. For each characteristic we present the percentage of respondents belonging to each factor level. Respondents were interviewed in Tarangire (TNP) and Saadani (SANAPA) National Parks, Tanzania in 2015.

Variable	Factor level	Range (TNP&SANAPA)	%TNP	%SANAPA
Park	TNP		50	50
	SANAPA		50	50
Village distance (km)		3&2	25	25
		6&3	25	25
		7&4	25	25
		9&5	25	25
Age (years)	Youth	18–26	10	12
	Adult	27–45	52.5	49.5
	Elder	> 46	37.5	38.5
Gender	Male		68	54.5
	Female		32	45.5
Economic activity	Farming		84.5	51
	Pastoralism& fishing		8.5	33
	Other		7	16
Level of education	Informal		22.5	19
	Primary graduate		61.5	66
	Secondary graduate or higher		16	15

among study villages, and for potential non-independence of respondents within each study village. To account for non-independence, we fitted a mixed-effects model (Bolker et al., 2009; Gelman and Hill, 2006), using the R-package 'glmmTMB' (Brooks et al., 2017). We examined differences in demographic and socio-economic characteristics of respondents between those that appreciated conservation benefits versus those that did not, and between those that had an impression that people in the village benefitted more from the park than the park itself. We used two binomial mixed-effects models, the first one included appreciation (0 = no, 1 = yes) as the response and the second included receiving benefits (0 = park, 1 = people in the village) as the response. Each model included six explanatory variables (park, village distance from the park, respondent's age, gender, type of economic activity performed by the respondent, and education level). Study village was included as random intercept. Characteristics of the respondents are given in (Table 1). All statistical analyses were performed using the R-software version 3.6.3 (R Core Team, 2020).

3. Results

The benefit appreciation was negatively related to the distance from park boundary (Estimate = -0.11 , SE = 0.04 , $z = -2.84$, $P = 0.004$) and differed significantly among villages ($\chi^2 = 28.64$, $df = 7$, $P < 0.001$). There was also a trend for differences in how people appreciated benefits between the three education levels ($\chi^2 = 5.26$, $df = 2$, $P = 0.072$, see Table S1). The impression whether people or the park itself received most benefits was also negatively related to distance from the park boundary (Estimate = -0.21 , SE = 0.04 , $z = -4.91$, $P < 0.001$), between the two parks ($\chi^2 = 27.60$, $df = 1$, $P < 0.001$) and among the eight villages ($\chi^2 = 47.20$, $df = 7$, $P < 0.001$). There was also a trend for differences among different economic activities ($\chi^2 = 5.75$, $df = 2$, $P = 0.056$).

In our models including all variables, the response on benefit appreciation decreased significantly with increasing distance from the two parks boundaries (Table 2). Thus, village distance from the park remained statistically significant in explaining benefit appreciation after accounting for other factors and the variation among villages (Table 2). Additionally, people who had secondary education and more, appreciated to receive more benefits associated with the presence of the parks around their vicinities compared to primary graduates and tended to appreciate more than those who never had been to school (informal education) (Table 2). The other four explanatory variables (park identity, respondent's age, gender, type of economic activity performed by the respondent), in our survey did not influence how local communities adjoining the two parks were appreciating the received conservation benefits (Table 2).

The other model including all variables revealed that communities surrounding TNP believed that the park itself benefitted more from collected revenues from tourism activities in and around the park, than the people in the villages around the parks. In comparison, the communities surrounding SANAPA believed that people in the village benefitted more from revenues than the park itself (Table 3). Thus, this effect differed between the two parks and remained significant after accounting for other factors and variation among villages. However, the impression that people or the park were the one benefiting most from the park revenues from tourism activities as explained by the distance from park boundary (Table S1) did not remain significant when accounting for other factors and the variation among villages (Table 3).

Table 2

Model output from a generalized linear mixed-effects model using the binomial response whether a respondent appreciate benefits from an adjacent national park. Questionnaires were used to obtain data from villages around Tarangire (TNP) and Saadani (SANAPA) National Parks, Tanzania in 2015. We report parameter estimates for the effect of park identity, village distance from the park, three age classes, gender, three groups of economic activity and three educational levels. Village identity was added as random intercepts to account for non-independence between each village. Reference levels are denoted within the table. Significant effects are depicted with asterisks.

		Estimate	SE	z-value	P \leq
Intercept		0.76	0.50	1.52	0.130
Park	Reference: SANAPA				
	TNP	0.67	0.43	1.56	0.118
Village distance (km)		-0.22	0.08	-2.73	0.006 **
Age (years)	Reference: Adult (27–45)				
	Elder (> 46)	0.01	0.23	0.03	0.975
	Youth (18–26)	-0.49	0.37	-1.32	0.186
Gender	Reference: Female				
	Male	0.10	0.23	0.45	0.654
Economic activity	Reference: Other				
	Farming	0.57	0.39	1.45	0.146
	Fishing & Pastoralism	0.41	0.42	0.96	0.335
Level of education	Reference: Secondary or higher				
	Informal	-0.66	0.38	-1.71	0.087
	Primary	-0.79	0.32	-2.45	0.014*

Table 3

Model output from a generalized linear mixed-effects model using the binomial response whether a respondent have the impression that the park itself (0) or locals (1) benefit most from being located close to a protected area. Questionnaires were used to obtain data from villages around Tarangire (TNP) and Saadani (SANAPA) National Parks, Tanzania in 2015. We report parameter estimates for the effect of park identity, village distance from the park, three age classes, gender, three groups of economic activity and three levels of education. Village identity was added as random intercepts to account for non-independence within each village. Reference levels are denoted within the table. Significant effects are depicted with asterisks.

		Estimate	SE	z-value	P≤
Intercept		1.47	0.53	2.79	0.005
Park	Reference: SANAPA				
	TNP	-0.87	0.44	-1.98	0.047 *
Village distance (km)		-0.08	0.08	-0.97	0.335
Age (years)	Reference: Adult (27–45)				
	Elder (> 46)	0.00	0.24	0.01	0.990
	Youth (18–26)	-0.04	0.40	-0.11	0.913
Gender	Reference: Female				
	Male	0.23	0.24	0.96	0.340
Economic activity	Reference: Other				
	Farming	-0.46	0.42	-1.08	0.279
	Fishing & Pastoralism	-0.35	0.47	-0.75	0.453
Level of education	Reference: Secondary or higher				
	Informal	0.45	0.41	1.11	0.267
	Primary	0.01	0.32	0.03	0.973

4. Discussion

In this study we show how local communities living closer to national parks and how individual education level positively affect how local people appreciate conservation benefits generated from the park. In addition, we show how local communities near TNP responded that more benefits were going to the park, thus benefitting the people in the village to a lower extent, while an opposite effect was found around SANAPA.

Most people in the studied communities earn less than one dollar per day (Croucher, 2020), across all employment categories, however, people from villages closer to the parks acknowledged to have received more conservation benefits compared to villages farther away. Different studies have found similar relationships, where communities living closer to protected areas acknowledged to receive more benefits compared to communities living farther away (Croucher, 2020; Molina Murillo et al., 2016; Nana and Tchamadeu, 2014; Nelson and Makko, 2005; Nepal and Spiteri, 2011).

Apart from being closer to the park boundaries, the element of education plays a vital role in motivating local communities to be active in conservation initiatives (Ardoin et al., 2020). Local people with secondary education or higher were more likely to appreciate conservation benefits than people with primary education level and tended to appreciate benefit more than those with no formal education. In addition, type of activity providing the living is usually another indication on how locals appreciate benefits (Galvin et al., 2020; Gardner, 2012; Kideghesho et al., 2007). Those who earns slightly more money than average have been shown to bear smaller costs associated by living closer to the park such as crop raiding and/or livestock depredation (Croucher, 2020; Mbise et al., 2018). However, we did not find a relationship between the type of employment and the appreciation of receiving benefits, or whether respondents thought that benefits were not reaching people in the village.

Communities surrounding TNP believed that the park benefited most in terms of the revenues collected from tourism activities compared to communities surrounding SANAPA, where people believed that they benefited more than the park. In Tanzania, the northern circuit, where TNP is located, receives more tourists compared to the southern circuit where SANAPA is located (Sosiya, 2016). Therefore, communities living adjacent to TNP can more easily estimate the benefits they receive compared to the reality than people living around SANAPA. However, due to employment at hotels and lodges, local businesses such as selling cultural fabrics, wood sculptures, farms products, animal art-works (*tingatinga*) etc., empower livelihoods to the communities living closer to the park (Kaaya and Chapman, 2017; Kideghesho et al., 2007; Lobora, 2016; Mashauri, 2017; Nelson and Makko, 2005).

Tanzania National Parks (TANAPA) has a community outreach department that supervises the relationship between parks and villages living adjacent to all parks. Besides monitoring the relationship this department also has a distinct budget that is distributed to the villages which supports initiated projects and social services such as water, wells, clinics and roads (Lobora, 2016; Mashauri, 2017). By doing such initiatives, communities realize these efforts which further strengthen the relationship between the people and parks (Allendorf, 2020; Lobora, 2016; Mashauri, 2017; Molina Murillo et al., 2016; TANAPA, 2015). However, there are some deviations that occur at individual level as such benefits are more widely appreciated at community level (Kaaya and Chapman, 2017; Kideghesho et al., 2007; Nelson and Makko, 2005). Sharing conservation benefits with communities adjoining protected areas is of paramount importance in conserving national parks. To create a big impact to communities, while rendering the benefits on the ground, there should be approaches that are relevant and adherent to the peoples' way of living (Abukari and Mwalyosi, 2020; Andrade and Rhodes, 2012; Galvin et al., 2020; Kaaya and Chapman, 2017;

Molina Murillo et al., 2016). Our findings are merely biased to one form of conservation incentives offered by national parks in Tanzania. Therefore, future studies are encouraged to assess the difference by including the other four categories of protected areas in Tanzania (i.e., Conservation Area, Game Reserve, Game Controlled Area, and Wildlife Management Area).

In conclusion, we found that distance from the park boundary and individual education level was the two most significant determinants of the appreciation of benefits from the park. Moreover, park identity was the most significant determinant of whether people in the village benefited most by having the national park, suggesting large variation across national parks in the degree of how local people receive benefits.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.gecco.2021.e01641](https://doi.org/10.1016/j.gecco.2021.e01641).

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