

A socio-economic survey of the Singchung Bugun Village Community Reserve, Arunachal Pradesh, India

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Community-managed lands often lack vital baseline information that assesses both natural resource dependence, as well as perceptions of power, involvement and support in management. We interviewed 171 households from 16 villages in the buffer of the Singchung Bugun Village Community Reserve (SBVCR) in Arunachal Pradesh, India. In total, 68% stated that SBVCR would be beneficial to wildlife and in terms of ecosystem services, and 45% expressed support for its formation. However, 76% identified multiple threats to the Reserve, including forest fires, hunting and agricultural expansion. Different parts of the Reserve were identified as being important for resource extraction, non-extractive uses and the need to be disturbance-free (with varying overlaps across these areas), thus calling for adaptive management.

Keywords: Adaptive management, biodiversity hotspot, conservation measures, community reserve.

APART from strictly protected areas, community-managed lands are effective in minimizing localized environmental threats¹ and have important biodiversity values². To ensure effective biodiversity conservation, however, it is important to understand the socio-political factors influencing conservation, and collect baseline information to aid monitoring and better preservation of community-managed lands.

Identifying the socio-political drivers underlying conservation, and evaluating the status of biodiversity is especially pertinent to Arunachal Pradesh in North East India, where 62% of the forests are under de facto community management³, and are witnessing increasing infrastructural⁴ and socio-economic changes⁵. Under such conditions, community reserves that are carved out from community-managed lands can only be effective if social norms and challenges are simultaneously assessed and considered. In February 2017, the Bugun tribe of Singchung village, West Kameng, Arunachal Pradesh, de-

clared a 17 sq. km Community Reserve known as the Singchung Bugun Village Community Reserve (hereafter SBVCR) on their traditional lands, abutting Eaglenest Wildlife Sanctuary (218 sq. km). Together, these protected areas form the centrepiece of the larger Kameng Protected Area Complex² of the Eastern Himalaya Biodiversity Hotspot, encompassing 3500 sq. km. The SBVCR is home to critically endangered species such as the passerine bird Bugun liocichla (*Liocichla bugunorum*), and the Fairrie's paphiopedilum orchid (*Paphiopedilum fairreanum*), in addition to endangered species such as red panda (*Ailurus fulgens*).

Prior to 2013 when SBVCR obtained formal declaration (from 2013 onwards), residents of Singchung village worked with the Forest Department, other local administration units and researchers to formalize the boundaries of the SBVCR. Traditionally, the Bugun community of Singchung village exercises customary rights over its lands, and practices Buddhism with certain embedded animistic beliefs². The SBVCR has a history of human use. Prior to a logging ban in 1996, there was commercial logging, road expansion for logging and/or for military purpose and large-scale removal of medicinal species⁶. The SBVCR was declared under Section 36C of India's Wild Life (Protection) Act of 1972 by Order No. CWL/D/21 (233)/2016-2017 to protect 'fauna, flora and traditional or cultural conservation values and practices'.

This study aims to understand the socio-economic profiles of residents amidst the establishment of SBVCR, use of forest-based resources, threats and perceptions about biodiversity, influence groups and support towards the Community Reserve.

Methods

Field methods

We collected data ensuring coverage of all villages in the Singchung administrative circle (Figure 1). We organized a training session with inputs from the Chairperson and

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staff of SBVCR. This training session was followed by data collection along with seven trained SBVCR enumerators in December 2017. We interviewed 171 people in 16 villages whose mean age was 40 years and comprised of 69% males. There were 56% Nepalis, 22% Buguns and 22% others. The sample size per village (10.37 (SD: 7.56)) was proportionate to each village size.

Our semi-structured questionnaire included information on demography, income sources/challenges, biodiversity perceptions and associated threats, assessing knowledge, support, influence groups and involvement with respect to the SBVCR ([Supplementary Material, Appendix 1](#)). We asked the interviewees to map areas that had different values of importance within the SBVCR.

Analytical methods

We used the open source statistical software R 3.4.1 (R Core Team 2016) for all analyses. At the village level, we used a non-metric dimension scaling with variables such as age, education, family size, income sources, income challenges, number of resources extracted, distance from the SBVCR, and support towards the Community Reserve. At the household level, we estimated the mean number of resources extracted. These were firewood, bamboo, *Swertia chiratiya*, star anise, timber, cane and wild meat. *S. chiratiya* is used in traditional medicine to treat ailments such as malaria and diabetes, while star anise is commonly used as a spice. From our field experiences in the area, we expected households to report muntjac (*Muntiacus muntjac*) as the used wild meat. At the individual level per household, we summarized the most frequently reported biodiversity values and threats within the SBVCR. Next, we generated a heatmap of values associated with different areas within the SBVCR and

examined their correlations. To understand awareness and support, we correlated distance of each village from the SBVCR with whether a respondent was aware or unaware of the Community Reserve. We examined whether the type of support towards the SBVCR varied by age, education and income distribution. To account for low and unequal sample sizes, we bootstrapped the samples 10,000 times to estimate means and 95% confidence interval (CI). Finally, we summed up the values of positive (1), negative (-1) and little influence/cannot say (0) to generate an aggregated influence group score.

Results

Socio-economic profiles, threats and resource-use

We did not find any difference in socio-economic profiles (stress = 0.14) across the 16 villages. A total of seven resources (firewood, bamboo, *S. chiratiya*, star anise, timber, cane and wild meat) were reportedly extracted from the forest, and 60% ($n = 103$) of households reported extracting resources from the SBVCR. The mean (CI) number of resources extracted per household was 1.12 (0.97, 1.34), with firewood being the most commonly extracted resource (88%, $n = 91$). An overwhelming majority (81.5%) of respondents ($n = 133$) considered that biodiversity has value. In fact, 68% stated that biodiversity had multiple values. No person responded that biodiversity had no value, although 18.5% was unaware of biodiversity values ($n = 30$). Ecosystem services was the most common biodiversity value (79%, $n = 105$), followed by cultural reasons for preservation (32%, $n = 43$), pride (32%, $n = 43$) and recreation (31.5%, $n = 42$).

Nine different threats to biodiversity/SBVCR were identified. These were fire, hunting, agricultural expansion, road building, logging, extraction of medicinal plants, agricultural intensification and loss of taboos. A majority (76%, $n = 130$) identified multiple threats (mean = 2.57 (2.44, 2.72)). Forest fire (83%, $n = 138$) was frequently reported as the major threat, followed by hunting (54%, $n = 90$) and agricultural expansion (31%, $n = 52$). Threats such as forest fire and agricultural expansion may be associated with farming, which was the most common income source (50%, $n = 84$), followed by tender and contract work (40%, $n = 67$) and shop keeping (14.5%, $n = 24$).

There were varying degrees of overlap between extractive, non-extractive and no-disturbance areas (Table 1). Specifically, areas perceived as important for hunting overlapped with those of harvest of other resources. Some areas that were identified as needing to be disturbance-free correlated with those perceived as good wildlife habitats, harvest grounds and those with potential to attract tourism (Figure 2).

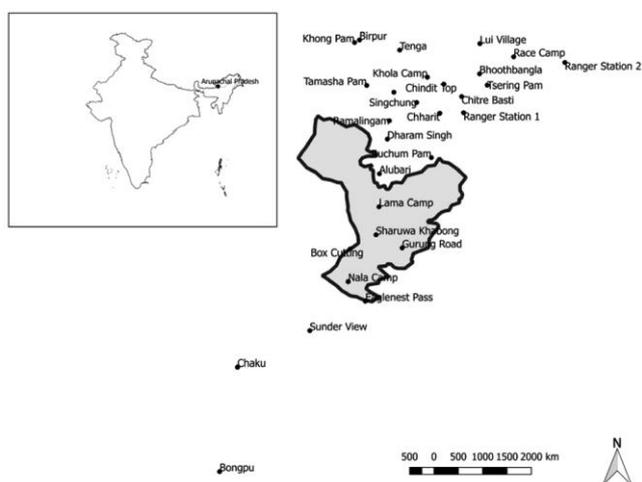


Figure 1. Map of Singchung Bugun Village Community Reserve (SBVCR), Arunachal Pradesh, India with the sampled villages and places of importance.

Table 1. Correlation table showing areas with correlated attributes

	Culture	Watershed	Hunting	Wildlife	No disturbance	Tourism	Extraction
Culture	1	0.36 (-0.15, 0.72)	0.15 - (-0.60, 0.37)	0.09 (-0.41, 0.56)	0.08 (-0.42, 0.55)	0.26 (-0.26, 0.67)	-0.13 (-0.58, 0.38)
Watershed	0.36 (-0.15, 0.72)	1	0.29 (-0.23, 0.69)	0.62 (0.19, 0.85)	0.22 (-0.30, 0.65)	0.43 (-0.08, 0.76)	0.18 (-0.33, 0.62)
Hunting	-0.15 (-0.60, 0.37)	0.29 (-0.23, 0.69)	1	0.32 (-0.20, 0.70)	0.29 (-0.23, 0.68)	0.17 (-0.35, 0.61)	0.82 (0.55, 0.93)
Wildlife	0.09 (-0.41, 0.56)	0.62 (0.19, 0.85)	0.32 (-0.20, 0.70)	1	0.69 (0.29, 0.88)	0.88 (0.68, 0.95)	0.30 (-0.22, 0.69)
No disturbance	0.08 (-0.42, 0.55)	0.22 (-0.30, 0.65)	0.29 (-0.23, 0.68)	0.69 (0.29, 0.88)	1	0.61 (0.16, 0.85)	0.57 (0.10, 0.83)
Tourism	0.26 (-0.26, 0.67)	0.43 (-0.08, 0.76)	0.17 (-0.35, 0.61)	0.88 (0.68, 0.95)	0.61 (0.16, 0.85)	1	0.18 (-0.34, 0.62)
Extraction	-0.13 (-0.58, 0.38)	0.18 (-0.33, 0.62)	0.82 (0.55, 0.93)	0.30 (-0.22, 0.69)	0.57 (0.10, 0.83)	0.18 (-0.34, 0.62)	1

Bold entries represent values where the 95% confidence interval did not overlap zero and hence statistically significant.

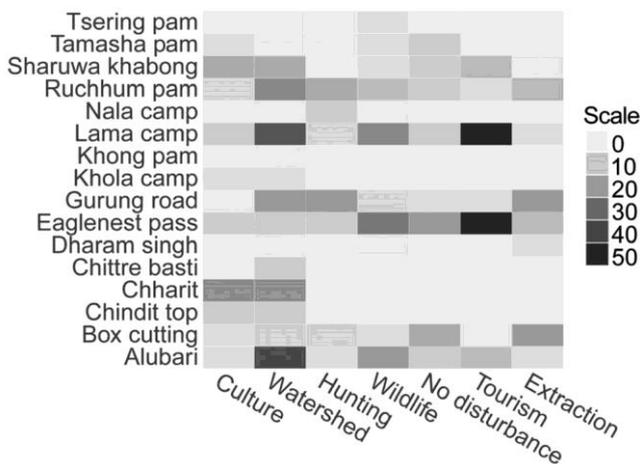


Figure 2. Heat map showing various places in and around SBVCR and the frequency of each attribute with each location.

Support and involvement in management

In total, 74 respondents had heard of the SBVCR, mainly by attending meetings (52%, *n* = 39), while 84 had not heard about the Community Reserve. Among the respondents who had heard about SBVCR, the mean (CI) distance of their village from its boundary was 2.04 km (1.76, 2.33), while people who had not heard about SBVCR lived further away (3.63 km (3.28, 3.90)). Overall, 116 respondents (68%) considered that SBVCR would be beneficial, while 42 respondents (25%) were either neutral or could not say. The average age (CI) of those who considered that SBVCR would be beneficial was lower (38.02 years (35.78, 39.97)) compared to those who were neutral or could not say (46.13 years (42.06, 50.88)). The group that thought that SBVCR would be

beneficial had higher formal education (5.17 years (4.32, 6.04)) compared to those who were neutral or could not say (3.9 years (2.66, 5.08)). The reverse was true for income source; those who were positive about SBVCR had fewer income sources (1.79 (1.35, 1.70)) compared to those who were neutral or could not say (2.18 (1.29, 1.92)).

A majority of respondents (45%, *n* = 74) agreed to support the SBVCR. The most common types of support they could provide or desired were participatory support at meetings (19%, *n* = 27), followed by management support (7.4%, *n* = 12) or being involved as full-time employees (3.7%, *n* = 6), but many were undecided of how they could participate (*n* = 42, 26%). A majority of respondents, mostly from the Bugun community, were positive about the SBVCR in terms of safeguarding future generations (*n* = 34, 92%) or their culture (*n* = 31, 84%). They also felt proud about the formation of the SBVCR (*n* = 24, 65%) and reported feeling a sense of power due to this (*n* = 24, 65%) (Figure 3). Local groups were perceived as being most influential (Figure 4). Specifically, religious leaders (influence score: 167, pujaris: 66, Buddhist leaders: 59, pastors: 42), older people (142) and local forest authorities (129) were perceived to be influential for conservation with politicians (40) being ranked lower.

Discussion

The study is a case in point about the need for factual assessments that can be further used to build management capacity on the ground. We found that the local population around the SBVCR is dependent on forest products and thus clearly stated that resource extraction policies were an important step for future harvesting.

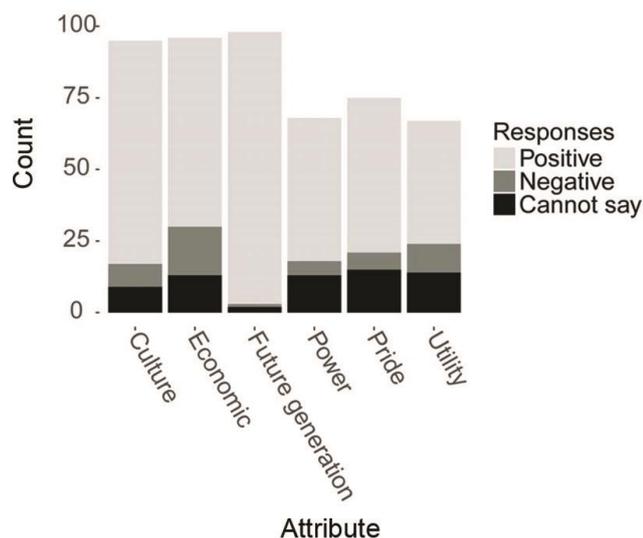


Figure 3. Response of people regarding the effect of SBVCR on six different individual/community attributes.

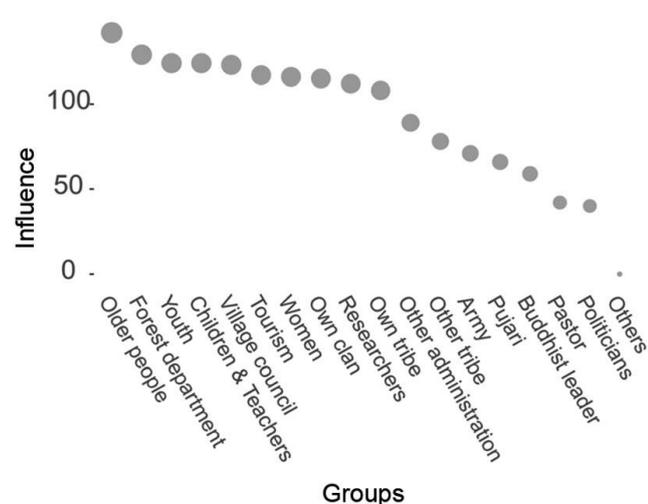


Figure 4. Influence scores for different groups on local conservation. The size of the filled circles also represents the influence of the respective groups.

Farming was the major source of income around the SBVCR. Formally, there is no land tenure, and the land in and around SBVCR is traditionally owned and farmed for subsistence by a few Bugun individuals. Presently, however, land is mostly leased to second and third generation farmers from elsewhere who grow crops such as cabbage, tomato and kiwi, which are replacing maize and potato that the Buguns once cultivated. Intact forests around the SBVCR are cleared for farming, accompanied by intensive use of mineral fertilizers and pesticides. Indeed, respondents identified agricultural expansion as one of the three major threats to the SBVCR, along with forest fire and hunting. These threats may not only lead to biodiversity loss⁷⁻⁹, but also potentially alter the provi-

sioning and ecosystem services arising from the Reserve, with downstream impacts on the economic well-being of the people.

Nevertheless, there is a general consensus that biodiversity has important values¹⁰. A majority agreed that biodiversity provides important ecosystem services such as providing clean water and air, and regulating local climate. In the context of rapidly accelerating climate change in the Himalayas¹¹, the preservation of forests is likely to become all the more essential to enable sustained provisioning of ecosystem services. Surprisingly, the utilitarian and economic uses of biodiversity are less appreciated, although majority use firewood, bamboo and medicinal plants.

The high degree of overlap between important hunting areas and those for resource extraction may indicate the need for active management (Table 1), especially during periods of financial difficulty October and March. Other areas have been identified for non-extractive uses which may need less management. These were areas that respondents simultaneously perceived as good wildlife habitats, no disturbance zones and places that could provide ecosystem services as watersheds and tourism (Table 1). The management plan that is underway will need to factor the different management options required over space and time.

Future discussions on the SBVCR can include dedicated conservation groups that may offer implementable suggestions on conservation matters. In particular, women who are committed to the cause of protecting biodiversity¹² should be encouraged to participate. Although, in general, the young and educated people supported the SBVCR, the older people are an important influence group. This highlights the need to create awareness among the older generation about the benefits of the Community Reserve and also continue conservation education programmes in government schools, where economically disadvantaged and less educated families are more likely to send their children. With appropriate biodiversity inventories, resource management strategies can be based on the differing and overlapping areas that have been assigned different values. This study is an important step that will help provide context-specific conservation efforts for one of the most biodiverse community reserves of the world.

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