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Challenges of human settlement on wildlife in Bale Mountains National Park, Southeast Ethiopia

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An investigation on challenges of human settlement on wildlife was carried out in 2014/2015 in and around Bale Mountains National Park. Among 25 villages bordering the National Park, 10 villages were purposefully selected for data collection. During the study period, semi-structured interviews and direct observations were conducted within the selected communities. A total of 365 households (35 households per villages, except 50 households for Rira) were randomly selected. Many parts of the protected area were found to be under cultivation. The main socio-economic activities of the respondents were mixed farming (58.0%) and livestock keeping (28.9%). The major reasons for off settlement near/inside the National Park were forage (52%), farming (25.6%) and both forage and farming (21.5%). Human settlement, agricultural expansions, and livestock grazing are the major problems of wildlife management inprotected area. Most of the cropland and human settlement expansions have been increasing from time to time and resulting in excessive losses of natural habitats for wildlife. This phenomenon was also attributed to migration of people from other places for farming and livestock grazing which has led to deforestation and intense decline in vegetation of protected area. Therefore, provision of appropriate conservation education should be emphasized for the local communities at different levels in the study area. Active measures have to be implemented to control the human settlement and livestock impact and safeguard the future of wildlife management in the park.

Key words: Bale Mountains, conservation, human settlement, park, wildlife.

INTRODUCTION

Today, protected areas are aimed to conserve biodiversity and large scale natural ecosystems. However, these protected areas are increasingly facing a number of challenges (Wearing and Neil, 1999; Suich, 2008). The tendency of establishing human settlements in previously wildlife areas is becoming common and endangering the future life of wildlife species (Ogutu et al., 2012). Such activities increase hand in hand with the increase in population growth and poverty (Galanti et al., 2006). Increased human population pressure and its negative impact on habitat loss in African countries is a common phenomenon (Newmark, 1996, Kideghesho et al., 2006). Some of the wildlife species in the Tarangire-Manyara ecosystem are reported locally extinct due to habitat destruction and overexploitation indicating high pressure of human impacts on wildlife (Shemweta and

and Kideghesho, 2000). The growing population pressure should be handled with care as the land is constant, while the human population is growing rapidly especially around protected areas (Kideghesho et al., 2006).

Human population growth bordering protected areas is high and has become a serious threat to the management of wildlife species all over Africa (Newmark et al., 1994). Many protected areas in Ethiopia are becoming isolated and the reasons for the isolation include growing human population in areas adjacent to protected areas and land use change towards agriculture, infrastructure, and settlement in areas that were previously unpopulated. Bale Mountains National Park (BMNP) is one of the most threatened National Parks (Mamo and Bekele, 2011; Vial et al., 2011). Most of Ethiopia's endemic wildlife is found in BMNP. However, the human population of Ethiopia reached about 85 million in 2013. If the current growth rate (2.3%) continues that means Ethiopia will reach 100 million. Increased population growth in Ethiopia goes hand in hand with the high demand on food requirement. Thus, in order to meet the requirement of the increased population, more cropland is needed at the expense of wildlife habitats, because an increasing food production is a priority. The expansion of cropland reduces natural ranges of many wild animals due to the loss of habitats and fragmentation which ultimately result into local extinctions of wildlife (Goldman, 2009). Several factors are responsible for local extinctions of these wildlife species, but the most pronounced are loss of habitat as a result of human settlement and expansion of cropland which are primarily pressured by increased human populations (Stephens et al., 2001; Woodroffe and Donnelly, 2011; Pittiglio et al., 2012). High human settlement in BMNP might pose challenges on the survival of wildlife there (Vial et al., 2011).

For many years, the natural habitats of Ethiopia have been altered by human settlement/pressures including overgrazing, which affect the wildlife. Majority of livestock production in Ethiopia takes place in afro-alpine grasslands (Laverenchenko et al., 1998; Vial et al., 2011). There is no published work on Bale National Park. Human settlement and livestock grazing is high in the BMNP (Vial et al., 2011). Moreover, the overall land coverage has been changing from time to time due to human activities within the park. The exact trend is not described by previous works. Therefore, the aim of the present study is to reveal the negative impacts of human settlements (livestock grazing, agricultural expansion) on wildlife in the study area.

MATERIALS AND METHODS

The study area

BMNP is situated in the southeastern highlands of Ethiopia, in the Oromia National Regional State of Bale Zone (Figure 1). The park encompasses 2,200 km^2 of mountains and forest. Geographically,

BMNP is located between 06°41' - 07°18'N and 39°03' - 40°00'E, about 400 km from Addis Ababa, the capital city of Ethiopia, BMNP contains the largest continuous area (over 1,000 km^2) of afro-alpine habitat in Africa (Vial et al., 2011). It covers an altitudinal range from 1,500 to 4,377 m asl (Fishpoll and Evans, 2001). Tullu Deemtu (at 4,377 m asl) in the Bale Mountains is the highest peak in Southern Ethiopia.

BMNP possesses one of the highest incidences of animal and plant endemicity among terrestrial habitats in Africa. In BMNP, there are at least 1321 species of flowering plants, of which 163 are endemic (23 to Bale alone) to Ethiopia. In BMNP afro-alpine areas of altitude >3400 m asl have a vegetation composition of *Erica arborea*, *Helichrysum* species, *Alchemilla* species, and giant *Lobelia* (*Lobelia rhyncopetalum*). The mountains are one of the centres of faunal diversity and endemicity, which generate numerous natural processes vital to human existence and support an important reservoir of genetic resources (EWNHS, 1996). BMNP is the home of diversity and endemism of fauna (EWNHS, 1996). The park supports 68 mammal species (Fishpool and Evans, 2001). The park is home to the largest populations of both the endemic and endangered Ethiopian wolf (*Canis simensis*) and Mountain Nyala (*Tragelaphus buxtoni*), as well as the endemic Bale monkey (*Chlorocebus djamdjamensis*) and the giant mole rat (*Tachyoryctes macrocephalus*). Over 170 bird species have been recorded in BMNP to date, about 20% of the species recorded for Ethiopia. Among the endemic birds of Ethiopia, 57% are found in Bale Mountains (IBC, 2007).

Before the establishment of BMNP, human population density and its impacts on the biodiversity of the area was not that much significant. In 1998, there was an estimated human population of 2,500. However, in 2003, the number of inhabitants was estimated over 40,000, representing a 16-fold increase in 20 years time (Stephens et al., 2001; BMNP, 2007). Many people live within the park's boundaries, increasing pressure on the natural resources of the area and diminishing natural habitats of wild animals.

Temperature of the area is variable, particularly in areas of the highest altitudes during the dry season and more or less the same pattern of temperature during the wet season. The highest temperature is 12.6°C in March and the lowest is 5°C in December (Vial et al., 2011). However, the temperature of the park normally ranges between 5 and 20°C. The warmest period of the year is between March and April. The coldest period is between November and December, and it can reach up to 1.5°C. Rainfall in BMNP is bimodal, with heavy rain during July to October and short rain during March to June. The annual rainfall ranges from 1000 to 1400 mm (EWNHS, 1996).

Data collection/Questionnaire survey

Questionnaire survey was conducted in 10 villages located within and around the BMNP. The ten villages were selected purposefully based on problems and accessibility. Totally, 365 households (HHs) were surveyed from all villages. The villages with the number of households include: Geremba Dima (35), Hora Soba (35), Gofingira (35), Gojera (35), Shedem (35), Rira (50), Angeso (35), Chiri (35), Irba (35), and Shawe (35). Thirty five households per village except 50 in Rira, because the village is totally inside the park. Selection of samples ensured representation of residents in the study area whereby number of households selected ensured above10% of all households in every respective village.

The study was carried out by means of a semi structured questionnaire and focus group discussion. In addition, direct observation of settlement and human activities in the protected area was carried out in the villages. The household data was collected using a semi-structured survey design, following a similar format to that used by Maddox (2003). One park management staff members and two district agricultural/natural resource management officers
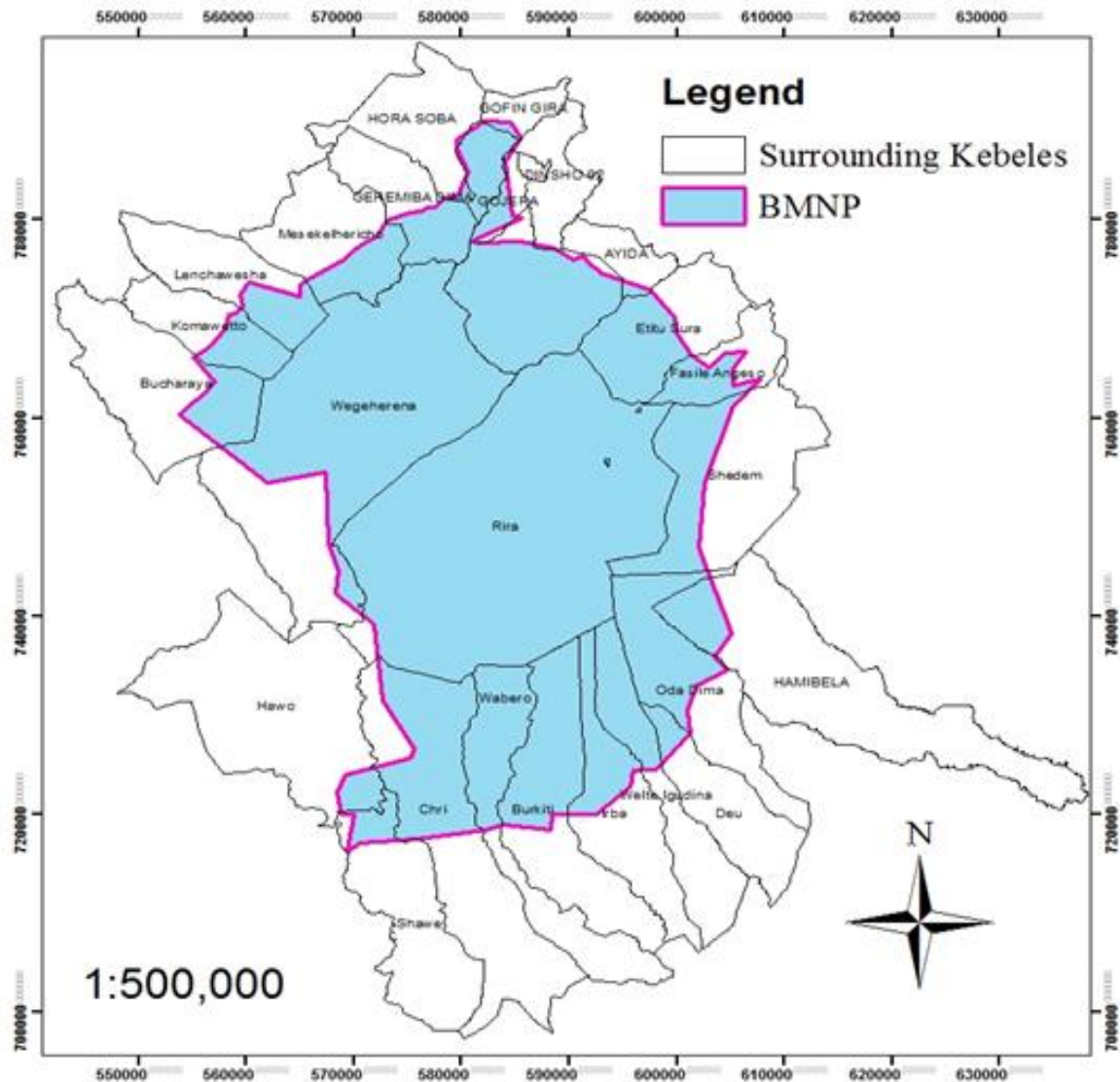
Figure 1. Map of the study area and the surrounding villages.

were involved in the research to facilitate the data collection. The questionnaire was administered to farmers within their area of farming and/or residence (Hill, 2000); at a random manner based on first come first serve basis (Newmark et al., 1994), and alternating male and female respondents as much as possible and different age groups. In every household, the head of the household or other representatives was interviewed. To understand the information, the questionnaires are translated into local language (Oromiffa). The structured questionnaires were administered using face to face interview that provided the family member to answer. Questions covered socioeconomic and demographic information, such as age, sex, education level, and village distance from the park boundary, their income source, trends and reasons of human settlement near/inside the national park, trends of agricultural expansion and livestock grazing and attitudes of settlers towards wildlife. Therefore, the main part of the questionnaire covered questions about the human settlement, livestock grazing, agricultural expansion and other activities that cause challenges on

wildlife in the national park. The data were processed and analyzed using Statistical Package of Social Science (SPSS) version 20.0, and descriptive statistics, chi-square tests were also used to determine the nature of the relationships among the variables.

RESULTS AND DISCUSSION

Demographic and educational status

Out of the 365 respondents, 277 (72.0%) and 98 (28.0%) were males and females, respectively. The age groups (years) of the respondents were grouped as 15 to 19 (18.5%), 20 to 29 (22.4%), 30 to 59 (45.2%) and more than 60 (13.9%). Educational level and attitude of the local people are shown in Table 1. More than 37% of the

Table 1. Educational level and attitude of the local people towards the park.

Educational level	N	Percentage	Attitude towards the park		
			Positive (%)	Negative (%)	No idea
Illiterate	135	37.1	43.8	43.4	12.8
Primary education	82	22.5	62.4	33.6	4.0
Secondary education	47	12.8	70.1	22.2	7.7
Informal education	101	27.6	52.9	34.0	13.1
Total/Average	365	100	57.3	33.3	9.4

Table 2. Villages and source of income status of the interviewed respondents.

Village	N	Income sources/Household economy		
		Farming (%)	Livestock (%)	Livestock and farming (%)
Geremba Dima	35	16.1	30.8	53.1
Hora Soba	35	12.3	26.3	61.4
Gofingira	35	13.4	30.1	56.5
Gojera	35	15.3	29.9	54.8
Shedem	35	13.7	30.0	56.3
Rira	50	16	23.1	50.9
Angeso	35	14.5	28.3	57.2
Chiri	35	11.7	22.9	65.4
Irba	35	10.1	29.2	60.7
Shawe	35	7.5	28.3	64.2
Total	365	13.1	28.9	58.0

interviewed respondents were illiterate, 22.5% had primary education, 12.8% had secondary education and 27.6% had informal education. Majority of the respondents (57.3%) had a positive attitude towards the park whereas an average 33.3% had negative attitudes. The difference was statistically significant ($\chi = 34.45$, df=2, P<0.05). Relatively, better-educated groups (primary and secondary education) had more positive attitude than non-educated groups.

The main social economic activities of the respondents were mixed farming and livestock keeping (Table 2). Most respondents were indigenous to the study area. For those who had migrated, there were different reason for why immigrants had moved into the area, including farming (13.1%), livestock keeping (28.9%), and both livestock and farming (58.0 %%). The difference was statistically significant ($\chi^2 = 31.15$, df = 2, P < 0.05). However, this was not significant among villages of farming ($\chi^2 = 5.17$, df = 9, P > 0.05) and livestock/pastoral ($\chi^2 = 3.49$, df = 9, P > 0.05).

Trends of human settlement in the last 10 years are shown in Table 3. Majority of the respondents (above 60%) indicated that in all villages, human settlement has been increasing during the last 10 years. The respondents noted that in all villages human settlement has increased during the last 5 years. Out of the 365 respondents, about 60% responded the trend is increasing. Only 18.9% noted the trend is decreasing. The difference was statistically significant on average trends of human settlement in and nearby the park ($\chi^2 = 68.47$, df = 3, P < 0.05). The views of the respondents did not differ significantly among these study villages.

The major reason of settlement near/inside the national park is shown in Table 4. Shortage of land for forage and for farming as well as both factors is the main reasons of human settlement in the study area. More than 52% mentioned their coming to the area is for livestock forage, 25.6% for farming and 21.5% for both forage and farming. The difference was statistically significant ($\chi^2 = 17.50$, df = 2, P < 0.05).

A trend of agricultural expansion is shown in Table 5. In all the villages, the agricultural expansion has been increasing inside and around protected area. The highest response was in Rira (74.1%). Averagely, 60.7% of the respondents noted as the agricultural expansion is increasing in and around the National Park in the last 10 years. Few respondents (16.8%) stated that agricultural expansion was decreasing in the protected area, and 12.7% were noticed as the same trend of agricultural expansion. The difference was statistically significant ($\chi^2 = 68.96$, df = 3, P < 0.05).

Livestock grazing in and around the park as well as

Table 3. Trends of human settlement in and nearby the park the last 10 years.

Village	N	Trends of human settlement in and around the park (%)			
		Increased	Decreased	The same	Unknown
Geremba Dima	35	59.4	21.9	17.2	1.5
Hora Soba	35	57.3	18.6	16.8	7.3
Gofingira	35	59.2	17.5	14.3	9.0
Gojera	35	55.9	16.8	13.5	13.8
Shedem	35	58.0	18.9	15.7	7.4
Rira	50	75.6	13.5	9.2	1.7
Angeso	35	50.2	18.4	18.3	13.1
Chiri	35	62.5	22.6	14.1	0.8
Irba	35	58.0	21.2	17.5	3.3
Shawe	35	62.5	19.8	15.1	2.6
Total/Average	365	59.9	18.9	15.2	6.0

Table 4. Reason for settlement near/inside the national park.

Village	N	Reason of settle near/inside the national park (%)		
		Lack of land for forage	Lack of land for farming	Both (forage and farming)
Geremba Dima	35	52.2	28.6	19.2
Hora Soba	35	54.4	29.2	16.4
Gofingira	35	58.0	26.5	15.5
Gojera	35	50.2	20.7	29.1
Shedem	35	59.1	29.1	11.8
Rira	50	41.9	20.3	37.8
Angeso	35	55.2	26.3	18.5
Chiri	35	56.3	25.5	18.2
Wabero	35	52.4	23.3	24.3
Shawe	35	49.7	26.4	23.9
Total/Average	365	52.9	25.6	21.5

Table 5. Trends of agricultural expansion in the last 10 years.

Village	N	Trends of agricultural expansion (%)			
		Increasing	Decreasing	The same	Unknown
GerembaDima	35	55.1	18.7	15.5	10.7
Hora Soba	35	57.3	19.1	12.7	10.9
Gofingira	35	61.7	16.0	14.5	7.8
Gojera	35	57.6	17.8	13.3	11.3
Shedem	35	62.9	19.6	9.3	8.2
Rira	50	74.1	8.6	11.0	6.3
Angeso	35	58.5	16.4	15.1	10.0
Chiri	35	57.4	17.6	10.2	14.8
Wabero	35	60.7	18.2	12.5	8.6
Shawe	35	61.5	15.6	13.4	9.5
Total/Average	365	60.7	16.8	12.7	9.8

time of grazing per year/months is shown in Table 6. Nearly half of the respondents (49.6%) graze their livestock inside the national park. About 35 and 15.9% graze livestock both (in and outside the park) and outside

Table 6. Livestock grazing and trends of livestock around the national park in the last 10 years.

Village	N	Livestock grazing (%)				Number of livestock around the national park (%)		
		Inside the park area	Outside the park	Both	Time of grazing in months	Increased	Decreased	The same
Geremba Dima	35	42.1	18.7	39.2	2-4	52.1	15.1	32.8
Hora Soba	35	44.3	19.1	36.6	2-4	53.2	13.4	33.4
Gofingira	35	48.7	16	35.3	2-4	55.5	14.1	30.4
Gojera	35	45.6	17.8	36.6	5-7	50.0	10.5	39.5
Shedem	35	49.9	19.6	30.5	2-4	54.9	14.7	30.4
Rira	50	80	0.0	20	8-10	61.4	9.8	28.8
Angeso	35	45.5	16.4	38.1	2-4	52.2	15.7	32.1
Chiri	35	43.4	17.6	39	2-4	53.9	12.0	34.1
Irba	35	47.7	18.2	34.1	2-4	54.5	13.1	32.4
Shawe	35	48.5	15.6	35.9	2-4	52.2	14.3	23.5
Total/Average	365	49.6	15.9	34.5	2-10	54.0	13.3	32.7

the park, respectively. The difference was statistically significant (χ^2 = 14.48, df = 2, P < 0.05). The time of grazing is varied. However, in Rira village all livestock is grazed inside the national park. The status of livestock around the national park in the last 10 years is increasing (Table 6). Most respondents (54.0%) mentioned the number of livestock is increasing from time to time. However, few respondents noticed decrease (13.3%) and the same (32.7%) number of livestock in the protected area. The difference was statistically significant (χ^2 = 24.89, df = 2, P < 0.05).

DISCUSSION

Collecting baseline information is a vital step in managing protected areas (Kumssa and Bekele, 2008). Therefore, the nature of the study required information from the responsible members of households. This helps to understand the timing, status and location of the challenges as well as the perceptions of local people towards protected areas. During the study period, sex of the respondents was not important in determining the attitude towards the protected area. However, young age groups showed relatively more significantly positive attitude than adult age groups. There was low level of formal education in the area due to tradition of pastoralist societies who do not encourage their children to attend schools instead many of them remain caring or shepherding of livestock.

Educated respondents supported protected areas more than those with no formal education. Conservation may be quite difficult in the future in areas like BMNP with people who are more illiterate. Support for conservation was positively correlated with the level of education of the respondents. Gadd (2005) also observed a similar situation in a study of people's attitudes towards the

wildlife in Kenya. Gadd (2005) also observed a similar situation in a study of people's attitudes towards the wildlife in Kenya and Ethiopia, respectively. In the present study, pastoralists move herds into protected areas in search of water and fodder. In doing so, pastoralist comes into direct competition with wildlife. Most respondents (56.2%) considered that the existence of the park had a positive attitude to conservation and indicated that the existence of the park will serve as a means of rangeland for their livestock during the wet season. Few respondents (35.6%) showed a negative attitude towards the park. Fear of displacement from the area by government is the major cause. They suggested that the park has to be free from human intervention. Similarly, a study in Tanzania found that the attitudes of local people were influenced by the services and benefits they personally receive from the protected area (Newmark et al., 1994). Therefore, it needs attention from concerned government and non governmental bodies.

The pastoralist society's income sources of household are mainly livestock keeping and small scale crop cultivations. Most of interviewed households mainly depended on livestock keeping and crop cultivation as sources of household income. This is partly a strategy to meet food demand as well as realizing the cost associated with keeping large herds of cattle. However, most livestock in the area local breed and the productivity is less. As a result, they depend on the number of livestock rather than quality. This might cause negative effect on the vegetation/wildlife habitat of the park.

Like most African countries, humans also put pressure on BMNP by various ways such as expansion of settlements, agricultural expansion, and livestock grazing. Livestock raring and agricultural expansion activities can have a wide negative impact, such as deforestation and loss wildlife habitat. The increased conversions of rangeland habitats have negative impacts

on wildlife as the habitat of wildlife is lost especially to bushland, woodland dwellers, and grassland habitats. The new types of land uses, such as agriculture, which have occupied large space have lead to destructions of natural vegetations and reduced area available for wild animals grazing and movements. Kideghesho et al. (2006) also mentioned similar problems of wildlife habitats for cultivation in other African country.

In most African countries, conflicts over natural resources are frequent (Stewart, 2002). The increased human settlement in the area has contributed greatly to lack of free space for animal movements as it can be translated to increased human settlements as observed in the study area during this survey; this observation is also supported by Ndibalema (2010) in Serengeti ecosystem. This has also resulted in shrinkage of the buffer zone area of the park. The park has been under increasing pressure from a rapidly growing pastoralist population and their livestock. High levels of livestock grazing in BMNP may affect the quality of the habitat suitable for the wildlife community. Vial et al. (2011) also noted as livestock grazing is very intense in BMNP. This is particularly the case in the BMNP area, where growing population has developed as threat protected areas directly by encroachment of wildlife area. A major bottleneck is the overstocking rate of livestock and human settlement leading to habitat loss through forest clearing for household consumption and for agriculture. Therefore, the present investigation revealed that the impact of illegal livestock grazing has been affecting the overall habitat of the national park.

Conclusion

Habitat destruction due to human activities is a potential threat to the survival of wildlife species in BMNP. Wildlife is under threat due to illegal human settlement, expansion agricultural lands, and livestock grazing in and around the protected area. Research findings show that there are major land uses changes which are associated with expansion of cropland cultivation and human settlements into areas that previously serves as wildlife habitats. These changes have negative impacts on the natural habitats of wildlife. Therefore, calls for involvement of not only conservationists, but also other stakeholders with different interests in the area and professional background, such as agriculturists, conservationists, demographers, policy makers, and land use planners to minimize the challenges. With this current trend of agriculture expansions and illegal human settlement which has already been put under cultivation of the park, the park will no longer act as a conservation area for wildlife as other protected area of the country. Therefore, provision of appropriate conservation education is important for the local communities/children at different levels of schools (primary, secondary, and

high schools). Also, continuous monitoring and evaluation process of effects of settlement in the park are needed for future conservation measures.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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