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Occupancy and Conservation Prospects of Endemic Banded Wattle-Eye *Platysteira laticincta* in the Kilum–Ijim Community Forest, Northwestern Cameroon

Valery A. Binda[1] and Theodore B. Mayaka[1]

Abstract

The banded wattle-eye bird species, BWE (*Platysteira laticincta*) is rare, endangered, and endemic to the Bamenda Highlands, Western Cameroon. Kilum–Ijim Community Forest is its last stronghold. Little is known about BWE's distribution and habitat requirements—the present baseline study aimed at reducing this knowledge gap. Bird occurrence—using call play-back technique—and vegetation variables were recorded in 50-m radius sampling plots placed in the altitude range 2,100 to 2,800 m. The BWE occurred at 43 (35%) of 123 plots mostly within Kilum sector of the Community Forest, at altitude range 2,168 to 2,707 m. The log-odds of BWE occurrence significantly (a) increased with canopy height, herb relative abundance, bare soil relative abundance, and shrub relative abundance and (b) decreased with altitude and understory height. These results suggest that the BWE may prefer forest areas at lower altitude with more bare ground and denser undergrowth cover. The implications for BWE conservation are discussed.

Keywords

banded wattle-eye, bird occurrence, conservation, endangered, endemic, Kilum–Ijim Community Forest

Introduction

The globally threatened banded wattle-eye, BWE (*Platysteira laticincta*) is a bird endemic to Bamenda Highlands (Cameroon), with the Kilum–Ijim Community Forest (KICF) as last stronghold (Forboseh & Ikfuingei, 2001; Stuart, 1986). The BWE is listed as endangered on IUCN Red List and is classed "A" (fully protected) under Cameroon's legislation (Djeukam, 2012; Forboseh & Ikfuingei, 2001). The species remains poorly studied with the only study on it being a 2½-decade-old preliminary survey focused on its population status (McKay, 1994).

Current data on BWE population distribution and ecological requirements are lacking (Dowsett-Lemaire & Dowsett, 1998; Forboseh, Keming, Toh, & Wultof, 2003). Therefore, any strategy for effective conservation of the BWE is hindered by a lack of baseline data (Brooks, Collar, Green, Marsden, & Pain, 2008; Forboseh et al., 2003). We researched the extent to which the occurrence of the BWE in the KICF is determined by altitude and vegetation structure. We hypothesized that the species' occurrence would be (a) mostly restricted to 2,000 to 2,800 m altitude range of the montane forest of which it is specialist (Forboseh et al., 2003; Ingram & Nsom Jam, 2007; Thomas, Anders, & Penn, 2000) and (b) influenced by the forest vegetation structure, as reported on several forest bird species elsewhere (Carvalho et al., 2015; Douglas et al., 2014).

Methods

This study occurred in the KICF (6°05′–6°20′N and 10°20′–10°34′E; ca. 20,000 ha; 1,600–3,011 m a.s.l., but

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mostly above 2,000 m), inside the Bamenda Highlands of northwestern Cameroon (Thomas et al., 2000; Figure 1).

Bird surveys were conducted in November 2016 to April 2017 which is dry season and species' nesting period (McKay & Coulthard, 1996) in the Kilum and Ijim mountain forests also known as the KICF. The study area is a mosaic of (Solefack, 2017) montane forest—of which the BWE is specialist (Ingram & Nsom Jam, 2007)—montane grassland, and subalpine vegetation. The survey was restricted to the montane forest, without need for stratification.

The bird survey combined the point-count method (Bibby, Burgess, & Hill, 1992) with call playback technique to increase the detectability of the BWE—the species is elusive (Gregory, Gibbons, & Donald, 2004)—in the period 06:30 to 11:30 of high detectability and low variation in activity, as a pilot study we undertook had found. The surveyor traversed transects of varying lengths—set up under the Kilum–Ijim Forest Project—that run from the forest fringe at around 2,100 m elevation toward the summit at 2,800 m elevation. Sampling plots of 50-m radius were established 100 m apart on alternate sides of the transect route (following Marsden, Jones, Linsley, Mead, & Hounsome, 1997) to minimize bias from edge effect. At each sampling plot center, the surveyor played the aggression call of the BWE—sourced from Xeno-Canto online database recommended by Woog, Renner, and Fjeldsa, (2010)—using a Sony ICD-UX533 tape recorder equipped with a portable Sony battery-powered 4 W speaker. The call broadcast was limited to 20 seconds (to avoid stressing the bird and influencing its normal behavior) and any response noted in the ensuing 30 seconds. At each sampling point, location, altitude, and distance between points were measured using a handheld Garmin 64s GPS receiver with an average error of 4 m. Although the species is known to occur between 1,800 m and 2,450 m (BirdLife International, 2012), surveys were extended a little beyond the 2,450 m upper limit, where possible, to confirm their absence as recommended by Gregory et al. (2004). Forest below 2,000 m a.s.l. has been converted to farmland (Valery A. Binda, personal observation) and surveying below the 1,800 m lower limit was thus not necessary.

Habitat selection by the BWE was investigated more fully through further vegetation assessment of all

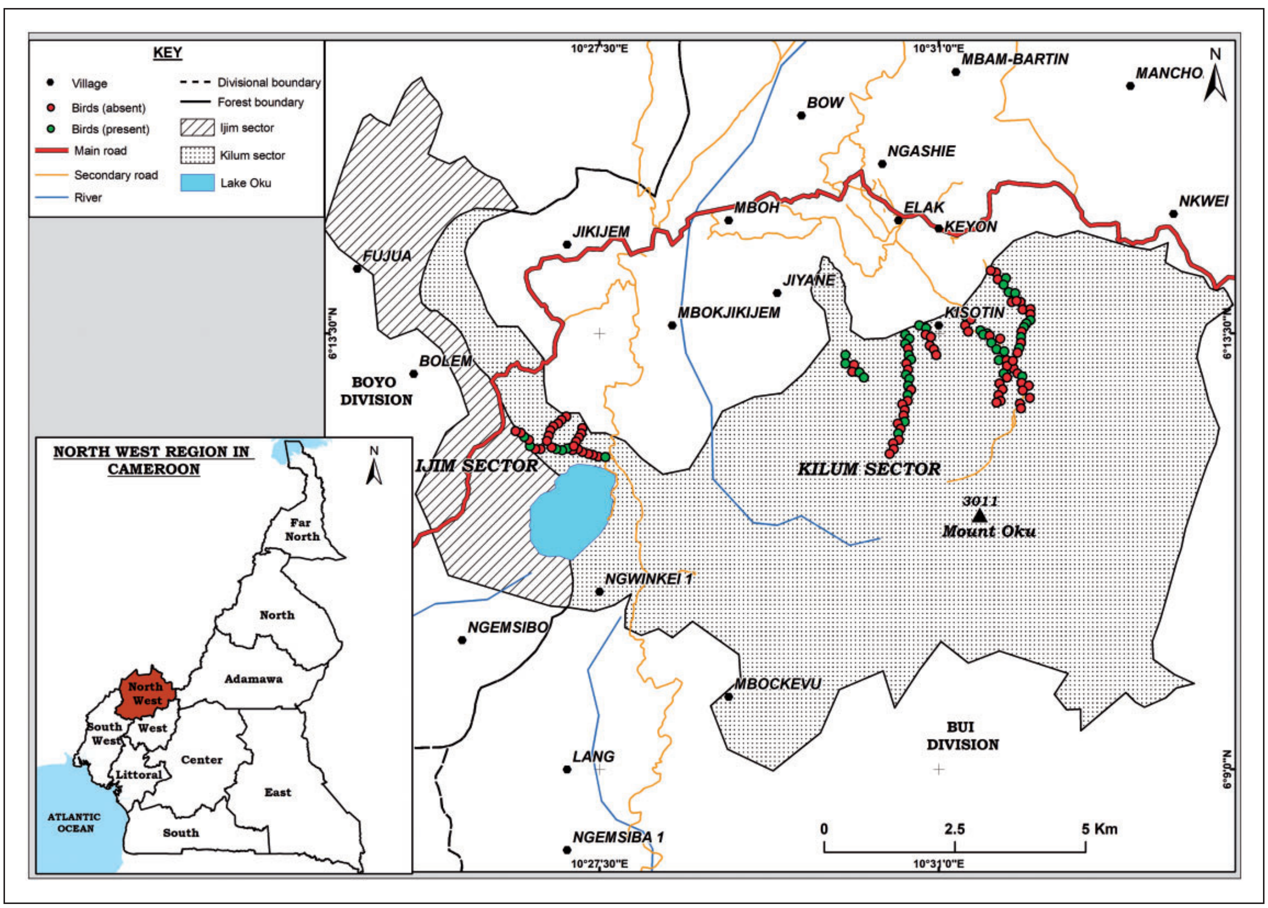

Figure 1. Geographic location of study area (Kilum–Ijim Community Forest) showing sampling units where the banded wattle-eye was detected (green dots) and not detected (red dots).

survey points. To avoid disturbing birds and for efficient time use, habitat surveys occurred each day after completion of the call playback sampling. For each sampling plot, measurement points were located at the northern, eastern, southern, and western ends of the plot with a fifth one in the center. Direction was estimated using a compass. Habitat measurements included (i) canopy height: the height of the tallest vegetation components above ground level, (ii) canopy cover: the proportion of the forest floor covered by the vertical projection of the tree crowns, (iii) understory height: average of vegetation between 2.4 and 11 m in height, and (iv) relative percentage abundance of stratified vegetation including (a) trees (perennial plants higher than 6 m with an emergent stem or trunk and branches made of wood), (b) shrubs (woody plants smaller than a tree but with several main stems arising at or near the ground, usually less than 6 m high), (c) herbs (seed-bearing plants which do not have a woody stem and dies down to the ground after flowering), and (d) bare soil (soil not covered by vegetation, litter or downed woody material). Canopy height and canopy cover were estimated using a Nikon Laser600 laser rangefinder and a spherical densiometer, respectively. Estimates of understory height and relative percentage abundance of trees, shrubs, herbs, and bare soil were made through direct observations. To avoid interobserver bias, observations were taken by a single observer.

All computations were performed under version 3.5.0 of software R (R Core Team, 2013). The covariables were mean-centered and scaled with scale () function, prior to a multicollinearity check. The BWE occurrence is a Bernoulli event with probability π. Thus, we used a binary logistic regression (Agresti, 2002; Venables & Ripley, 2002) to model the logit of occurrence probability as a linear predictor function of altitude X (linear and quadratic gradients) and the subset of habitat characteristics $\{Z_p\}$ that passed the automated selection. The human signs were not included in the model, as few were recorded in Ijim subarea of study. Altitude is meaningful both ecologically (for a montane forest specialist like BWE) and statistically (for testing the altitude gradient). Latitude did not pass the criterion for entering the model which read thus:

$$\text{logit}(\pi_{ijk}) = \alpha_0 + \delta_0 + (\alpha_1 + \delta_1)X_{ijk} + (\alpha_{11} + \delta_2)X_{ijk}^2 + \sum_{p=1}^{P} \beta_p Z_{pijk}$$

where π_{ijk} is the BWE's occurrence probability at sampling plot k in transect j of area i; α_0 α_1, and α_{11} are respectively the intercept, linear gradient, and quadratic gradient of altitude in Kilum area (reference level); δ_0, δ_1, and δ_2 are the corresponding differential gradient effects for the Ijim sector; the $\beta_p''s$ are the regression coefficients of habitat characteristics. The aforementioned model was simplified through gradual removal of the interaction effects, after due tests, namely, $H_0^{(i)}:\ \delta_i = 0$ versus $H_1^{(i)}:\ \delta_i \neq 0$, using a chi-squared approximation of the Likelihood ratio test at 5% significance probability level. The final model was selected using the Akaike's information criterion.

Results

The BWE occurred in 2,168 to 2,707 m altitude range. The birds were recorded in 39% of Kilum plots (37 of $n = 93$ plots), 20% of Ijim plots (6 of $n = 30$ plots), and in 35% of the overall plots (43 of $n = 123$ plots). See Figure 1 for location of detections and column 3 of Table 1 for detailed statistics.

The vegetation in Ijim compared to that of Kilum is as follows (Table 1): a taller understory, a greater shrub relative abundance, a lower canopy height, a lower tree relative abundance, a smaller bare soil relative abundance, and similar herb relative abundance.

None of the interaction effects was significant at 5% probability level. As seen in Table 2, the log-odds of BWE occurrence significantly: (a) increased with canopy height, shrub relative abundance, herb relative abundance, bare soil relative abundance and (b) decreased with altitude and understory height.

Discussion

The 2,100 to 2,800 m altitude range within which the BWE occurred during this study differs from the 1,800 to 2,450 m range previously reported (BirdLife International, 2012; McKay & Coulthard, 1996). This is a cause for concern as not only the forest below 2,000 m a.s.l. has been already converted to farmland, but the species seems to avoid altitudes higher than 2,500 m (see Figure 2). The absence of a buffer zone exposes the forest fringes at lower altitude to disturbance and encroachment from farming activities (Valery A. Binda, personal observation). This presents a serious threat to the BWE which seems to prefer forest areas at lower altitude.

The study corroborated previous reports on the bird's preference for areas with abundant herbs (Maisels, as cited in BirdLife International, 2012). Even though the Ministry of Forestry and Wildlife (MINFOF) placed a legal ban on grazing activities at the summit (Muam, 2004), these activities remain intensive. Livestock—mainly goats and sheep from the summit now encroach into adjacent forest areas (see Figure 3) where they browse on seedlings and mature herbs within their reach. This is a conservation threat especially to the BWE which inhabits thick undergrowth cover and

Table 1. Mean (± SD) BWE detection rate and vegetation measurements at transect and sector level †.

Area	Transect	Detection	Canopy height	Understorey height	Tree relative abundance	Shrub relative abundance	Herb relative abundance	Baresoil relative abundance
Ijim sector	Ijim1	0.33 (0.49)	16.60 (2.59)	4.08 (0.60)	27.00 (12.24)	27.90 (6.00)	41.10 (13.17)	3.89 (2.49)
	Ijim2	0.00 (0.00)	19.00 (1.22)	4.96 (0.09)	10.40 (0.94)	50.60 (14.31)	36.20 (13.86)	2.80 (0.45)
	Ijim3	0.00 (0.00)	16.70 (1.70)	4.51 (0.29)	13.40 (3.05)	43.40 (10.73)	40.90 (13.77)	2.00 (0.00)
Overall Average		0.20 (0.41)	17.00 (2.35)	4.33 (0.59)	21.20 (12.11)	35.40 (12.83)	40.20 (13.10)	3.27 (2.08)
Kilum sector	Klm1	0.40 (0.50)	19.40 (2.43)	3.15 (0.65)	30.8 (7.52)	26.80 (6.00)	39.00 (10.56)	5.40 (4.69)
	Klm2	0.46 (0.52)	18.40 (4.89)	3.01 (0.48)	24.2 (12.39)	23.80 (9.86)	51.00 (19.54)	2.46 (1.13)
	Klm3	0.13 (0.35)	15.40 (2.13)	2.54 (0.70)	27.00 (20.22)	16.40 (10.35)	55.10 (24.84)	1.50 (0.54)
	Klm4	0.41 (0.50)	20.30 (2.66)	2.91 (0.48)	30.10 (6.70)	28.00 (4.53)	37.40 (5.34)	4.14 (2.88)
	Klm5	0.44 (0.51)	18.30 (2.24)	3.48 (1.08)	31.60 (6.14)	22.80 (3.86)	38.40 (6.98)	6.72 (4.15)
Overall average		0.40 (0.49)	18.80 (3.11)	3.11 (0.76)	29.60 (9.58)	24.70 (7.04)	41.5 (13.5)	4.71 (3.90)

†: The means and standard deviations are based on the following number or replicates (sampling stations) per transect: Ijim1: 18; Ijim2: 5; Ijim3: 7; Klm1: 25; Klm2: 13; Klm3: 8; Klm4: 22; and Klm5: 25.

Table 2. Output of Logistic Regression for Predicting Occurrence Probability of the Banded Wattle-Eye.

Coefficient (predictor)	Effect (standard error)	*Z* (Wald's statistic)
α_0 (intercept)	−0.610 (0.473)	−1.290
α_1 (altitude, linear gradient)	−0.376 (0.352)	−1.069
α_{11} (altitude, quadratic gradient)	−1.072 (0.362)	−2.963***
β_1 (canopy height)	2.844 (0.630)	4.513***
β_2 (understory height)	−1.362 (0.647)	−2.105*
β_3 (shrub relative abundance)	1.436 (0.659)	2.179*
β_4 (herb relative abundance)	2.894 (0.808)	3.582***
β_5 (bare soil relative abundance)	2.246 (0.676)	3.325***

***, *: significance at probability levels of .001, and .05, respectively.

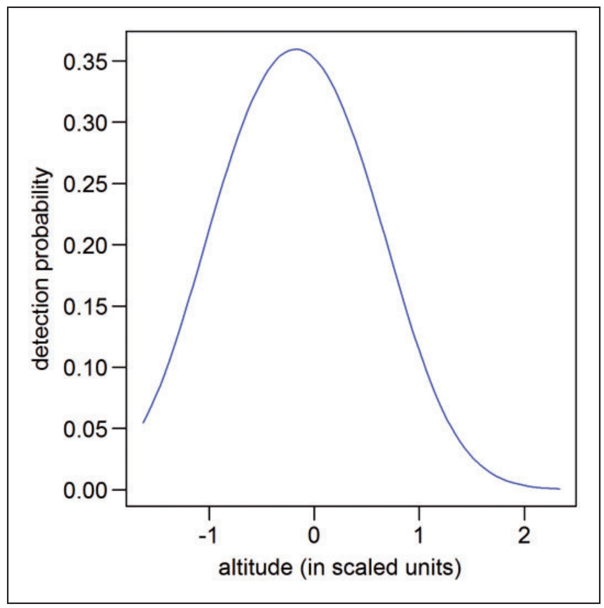

Figure 2. Change in the detection probability of BWE with altitude (in scale units) using the fitted regression model. The detection probability reaches a maximum at about 2,500 m, that is, the upper range limit reported by BirdLife International (2012) then decreases, all habitat characteristics being equal.

nests close to the ground (Valery A. Binda, personal observation). The BWE preference for thick undergrowth cover makes it extremely vulnerable to habitat destruction by forest fires which according to Fotso (1996) are often started accidentally by beekeepers and farmers. It also exposes the BWE to reproductive failure resulting from egg collection by children and nest destruction by forest users. BWE prefer areas with high-canopy trees comprising a large proportion of species that are exploited for their high economic value: *Prunus africana*, *Podocarpus latifolius*, and *Schefflera* spp. The indiscriminate felling of these tree species threatens the BWE

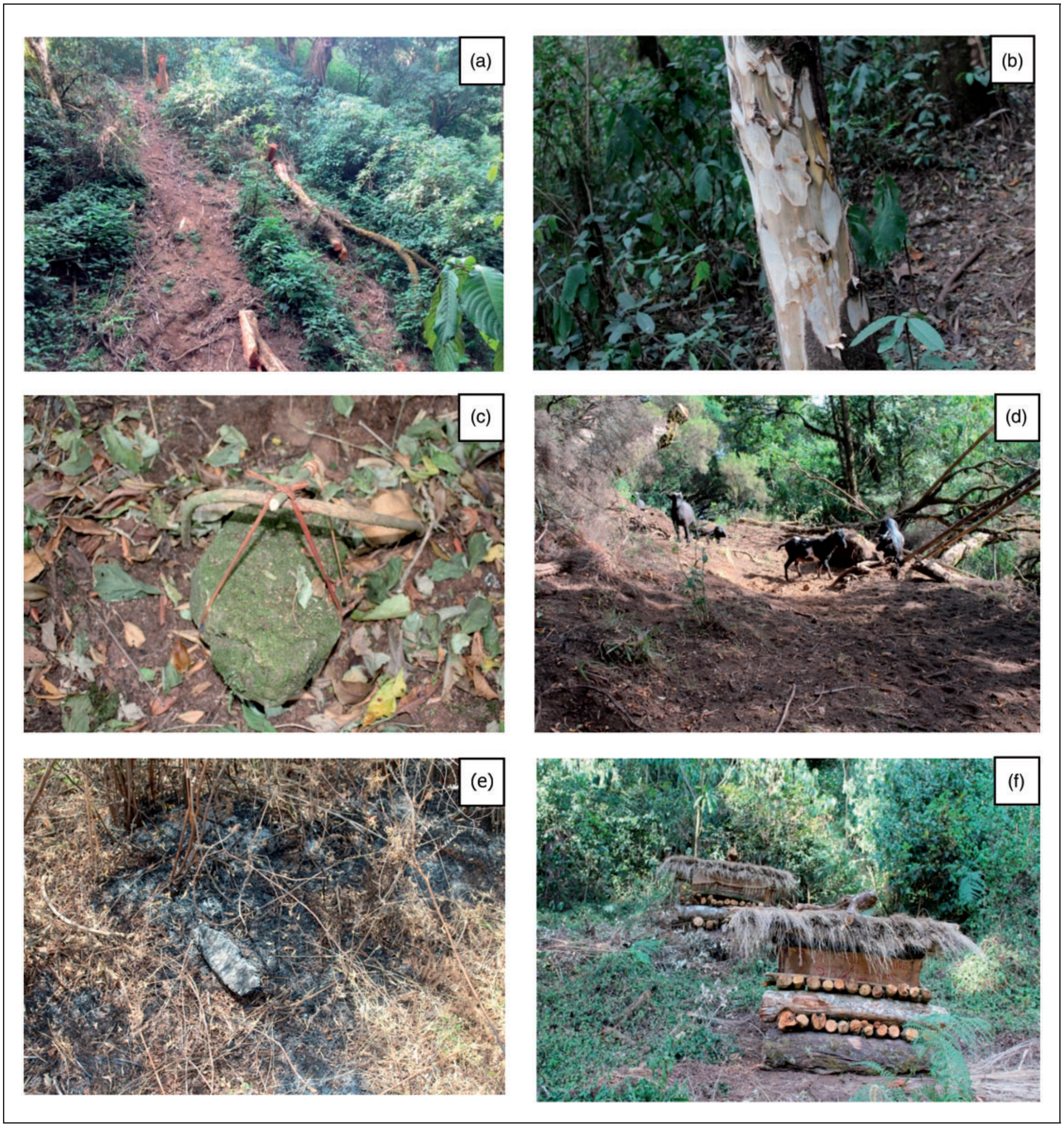

Figure 3. Photographs of signs of various human activities in the KICF recorded during the study: (a) felling, (b) debarking, (c) snare, (d) grazing, (e) fire, and (f) beehives. Photo credit: Valery A. Binda.

whose occurrence is favored by their high canopies. Forest management must be shared among traditional authorities, local communities, and MINFOF (Thomas et al., 2000); however, MINFOF has been weak in her role of law enforcement and monitoring.

Implications for Conservation

Our knowledge of the BWE is still insufficient; however, this study identified vegetation characteristics preferred by the BWE and discusses potential human threats to the species within the KICF. Fire remains the most damaging threat to the species and its habitat. MINFOF should ban bushfires or keep them to strict necessity within and around forest boundaries. Creating and maintaining a buffer zone between the forest and farms, and a fire-watch system could also be an effective approach in preventing forest fires. A buffer zone would also prevent further encroachment of forest fringes at lower altitude from farming activities which could be a serious threat to the BWE that seems to prefer forest areas at lower altitude. The use of beekeeping techniques that minimize fire hazards should be promoted. The enforcement of the forest-wide rules is paramount to the success of community forest management. A permanent MINFOF structure should be instituted to support and monitor the management and utilization of the forest by local communities, and to ensure that bans on grazing, bushfires, and indiscriminate felling of trees are enforced. Environmental education and conservation outreach programs targeting the BWE should be implemented.

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