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Roosting Behavior and Roost Selection by Buff-throated Partridges *Tetraophasis szechenyii* during the Breeding Season

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Yu Xu, Nan Yang, Ying Wang, Bi-Song Yue, and Jiang-Hong Ran (2010) Roosting behavior and roost selection by Buff-throated Partridges *Tetraophasis szechenyii* during the breeding season. *Zoological Studies* **49**(4): 461-469. Studying roosting behavior and roost selection is very important for Galliformes conservation. The breeding season roosting behavior and roost selection by Buff-throated Partridges *Tetraophasis szechenyii*, a rare galliform species endemic to western China, were studied by radio tracking and direct sighting in 2006-2008. Partridges roosted in family groups, and group members almost always huddled together within roosts except in the incubation period and the 1st 2 wks after the eggs hatched, when males remained separate from females. The vegetation they selected for roosts was almost exclusively fir forests with high tree density, good canopy cover, and plenty of trees with large diameter at breast height (DBH). Trees typically used were large-DBH (27.3 ± 1.1 cm S.E., n = 58) *Abies squamata* or *Larix potaninii* situated on sites with large degree of slope, long distance to the nearest trail, and close proximity to other large-DBH trees. Branches occupied were frequently (47.2%, n = 74) easterly oriented, and 7.4 ± 0.1 m S.E. (n = 95) in height and 4.2 ± 0.1 cm S.E. (n = 95) in diameter. This suggests that the roosting behavior and patterns of roost selection by Buff-throated Partridges are principally to maximize thermoregulatory benefits and avoid predation. The relevance for management of this species is mainly discussed in terms of forestry practices and exploitation restraints. http://zoolstud.sinica.edu.tw/Journals/49.4/461.pdf

Key words: Group roosting, Behavior, Habitat selection, Buff-throated Partridge, Galliformes.

Night roosts play a crucial role in bird biology because of the large amount of time birds spend roosting during the night and their presumed vulnerability to inclement weather and predation when asleep (Cody 1985, Woltmann 2004). Roosting behavior and roost selection are likely to be important determinants of individual fitness (Fisher et al. 2004), with particular consequences for energy budgets and predator avoidance (Walsberg 1983).

This is particularly true for the Galliformes, an avian group characterized by a poor dispersal ability and limited spatial movements. To our knowledge, many galliform species show group roosting behavior even in the breeding season, which has been hypothesized to have benefits in terms of reduced thermoregulatory costs, decreased predation risk, and increased foraging efficiency (Eiserer 1984, Beauchamp 1999); and their selection of roosts is not random: they prefer places that can provide benefits for thermoregulation and predation avoidance. For example, forest-dwelling species (e.g., *Syrmaticus ellioti*, Ding et al. 2002; *S. reevesii*, Sun et al. 2002; *Crossoptilon crossoptilon*, Jia et al. 2005; *S. humiae*, Jiang et al. 2006) usually roost in large-diameter trees, and sites where roosting trees occur have high tree densities (e.g., Sun et al. 2002, Thompson 2003, Jiang et al. 2006), high percentages of canopy cover (e.g., Rumble 1992,

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Ding et al. 2002, Lu and Zheng 2002, Thompson 2003, Jia et al. 2005, Sweringin 2007), great amounts of large-diameter trees (e.g., Rumble 1992, Thompson 2003, Sweringin 2007), and steep slopes (e.g., Liang 2000, Ding et al. 2002, Sun et al. 2002, Jia et al. 2005, Jiang et al. 2006). Acquiring knowledge of the roosting behavior and roost selection by the Galliformes will undoubtedly aid in the management and conservation of these species (Fisher et al. 2004).

The Buff-throated Partridge *Tetraophasis szechenyii* is a galliform species endemic to western China. It is considered to be vulnerable according to the *Red Book of China* (Wang and Xie 2004), and is legally listed as a category I species of nationally protected animals in China, because it is threatened by habitat loss and degradation, and a reportedly high rate of hunting (Mackinnon et al. 2000, Klaus et al. 2003, Li 2004, Wang and Xie 2004). As this species inhabits coniferous forests, alpine shrublands, and tundra above the tree line at 3,350- 4,600 m in elevation (Mackinnon et al. 2000), where environmental factors can be severe (e.g., low ambient temperatures), predator pressure can be high, and individuals spend a large amount of time roosting during the night (Xu et al. 2008), their roosting behavior is probably unique, and roost selection is likely very strictly controlled. However, to date, nothing is known about these aspects of this species. We therefore examined their night roosting behavior and roost selection during the breeding season. The major objectives were to (1) determine whether group or communal roosting occurs in this species and if there are any temporal changes, and (2) identify habitat factors associated with the roost selection by this species.

MATERIALS AND METHODS

Study area

The study area was located in Pamuling Mountain (30°06'N, 101°11'E), Yajiang County, Ganzi Tibetan Autonomous Prefecture, Sichuan, China (Fig. 1). The area of the study site was about 340 ha, and the elevation ranged 3,900-4,200 m. The climate is the sub-humid type of the Qinghai-Tibetan plateau. The mean temperatures at sunrise (sunset) were 2.7 (7.0) and 4.7 (8.4)°C in Apr.-May and June-Oct., respectively.

Fieldwork

Buff-throated Partridges lived in groups in the study area, and 15 groups were observed in Apr.-Oct. 2006 (n = 5) and Apr.-May 2007 (n = 8) and 2008 (n = 2). Eight birds from 3 groups were captured and fitted with colored leg bands, and 2 adult males were equipped with necklace-transmitters (model RI-2D, weight 18.5 g, frequency 164-165.999 MHz, lifespan 36 mos; Holohil Systems, Carp, Canada). But other groups (n = 12) could be recognized by their exclusive territories and the unique plumage differences of individual birds. Groups were located by radio tracking or direct sighting (for more details see Xu et al. 2008). Once a group was located, it was followed without disturbing it (because a monastery was located on the mountain, the partridges were particularly tame and they could be approached within 10 m without affecting their behavior), and its roosting site was observed until all members had entered the roost, at which point a visual location was obtained. During this process, the general behavior of the partridges was recorded (e.g., spatial distance between members, and roosting height). The roosting site was flagged, and the coordinates were marked with a GPS (model Etrex Venture; Garmin, Taipei, Taiwan), after which we immediately left. The next morning, we revisited the roosting site 30 min before sunrise to determine whether the roost was abandoned by the group or not. Habitat characteristics were measured after the partridges had departed.

Habitat description

We determined the roosting habitat of Buff-throated Partridges from macro- and microhabiat scales. In the study, macrohabitats were identified by distinct changes in vegetation type and were described based on the dominant species of vegetation (Rumble 1992). Four macrohabitat types were discriminated in the study area: (1) fir forests (FF), dominated by *Abies squamata* and *Larix potaninii* (the proportion of occurrence between these 2 tree species was 2.19: 1, n = 58), which occurred on northern slopes, (2) oak thickets (OT), dominated by *Quercus aquifolioides*, which occurred on southern slopes, (3) rhododendron shrubs (RS), dominated by *Rhododendron nitidulum*, *Salix* spp., and *Dasiphora fruticosa*, which occurred on northern slopes, and (4) alpine meadows (AM), dominated by *Kobresia setchwanensis*, *Polygonum viviparum*, *Potentilla*

discolor, and *Hemiphragma heterophyllum*, which occurred on the plateau of the study area and were generally flat (Table 1).

Microhabitats were evaluated at 2 scales (roosting tree and roosting branch). On the roosting tree scale, habitat variables of roosting trees measured included diameter at breast height (DBH), distance to the nearest tree, DBH of the nearest tree, distance to the nearest trail, distance to the nearest forest edge, and degree of slope (Table 1); surrounding each roosting tree, habitat variables, including tree density, tree cover, average DBH of trees, and shrub cover (Table 1), were measured by employing 10 × l0 m plots (0.01 ha) with the roosting tree at the center. Elevation and aspect of slope were not included in the measurement, because there were no obvious variations in them due to the range of the study area and the method of choosing random trees (see below). At the roosting branch scale, habitat variables measured included roosting branch height and diameter (of the trunk end) and orientation (recorded as 4 categories: 316°-360°N and 0°-45°N; 46°-135°E; 136°-225°S; and 226°-315°W). Diameter variables were measured with calipers; physiographical variables were measured with a GPS and a clinometer; distance variables were measured with a tape measure; and cover variables were visually estimated following Prodon and Lebreton (1981).

Simply documenting habitat characteristics in and around roosting trees does not allow for an explicit statement of how these trees differ from other available ones (Fisher et al. 2004). To quantitatively assess the roost selection by the birds, we chose random trees for comparison with roosting trees. A random tree (if there was no tree at the location, the nearest tree to the location was viewed as the random tree) was chosen in a randomly determined direction for a distance

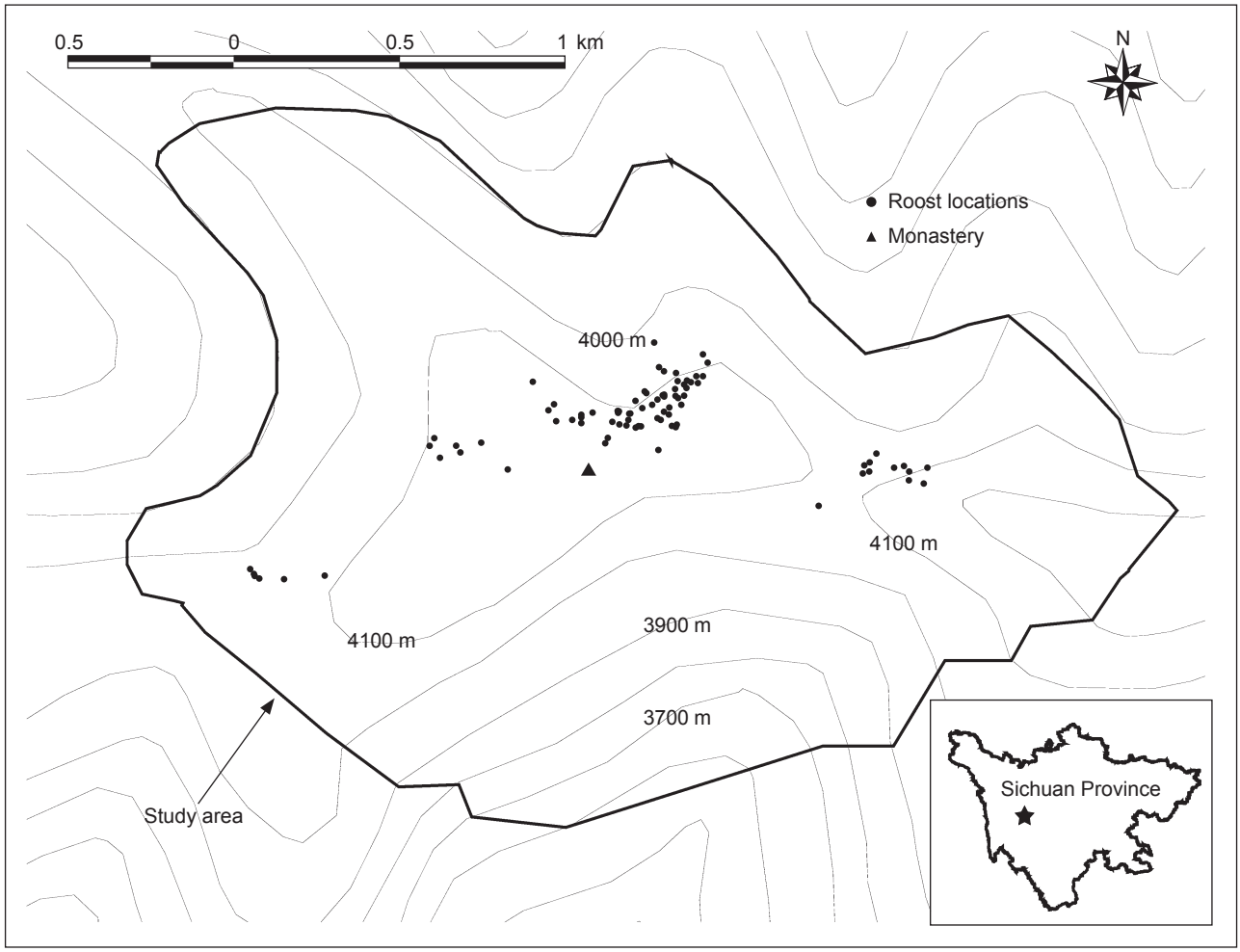

Fig. 1. Map showing the study area (30°06'N, 101°11'E) with roost locations.

of 100 m from the roosting tree (e.g., Thompson 2003, Jiang et al. 2006), but still within the general macrohabitat boundaries in order to insure that key influences on habitat selection were not missed (Johnson 1980, Orians and Wittenberger 1991, Jones 2001). The same measurements were taken as those at the roosting tree (Table 1).

Data analysis

As the roosting behavior by Buff-throated Partridges varied with periods of breeding (see "RESULTS"), we used the following categories in the analyses: incubation (about 23 ds), early post-hatching (the 1st 2 wks of chicks' lives), and other breeding periods (including the pairing period and the mid-to-late post-hatching period up to when chicks turned 5 mo old). The statistical analyses used included Chi-square tests, principal component (PC) analysis (PCA), and generalized linear mixed models (GLMMs). Chi-square tests were used to determine whether roosting tree species were selected disproportionately from expected use, and whether the selection of the orientation of roosting branches differed from a random distribution (SPSS vers. 11.0, SPSS 2001). The use of macrohabitats (i.e., vegetation types) was not examined by Chi-square tests, because the use was almost exclusive (Table 2). GLMMs were used to analyze the probability of finding a roosting tree, by examining habitat differences between roosting trees and random trees. But before beginning the models, to obtain habitat gradients and summarize patterns of covariance in habitat variables (Iamsiri and Gale 2008), a PCA on the correlation matrix was first performed in SPSS vers. 11.0 (SPSS 2001); note that habitat variables were transformed for normality prior to the PCA using log and root-square transformations. Then the GLMMs were implemented using PROC GLIMMIX in SAS vers. 9.1.3 (SAS Institute 2005), with the binomial error

Table 1. Descriptive statistics of habitat variables measured at the roosting tree scale of Buff-throated Partridges on Pamuling Mountain, Sichuan, China, 2006-2008[a]

Habitat variable	Roost (n = 58)		Random (n = 58)	
	Mean ± S.E.	Range	Mean ± S.E.	Range
Degree of slope (°)	39.5 ± 0.4	29.0 - 47.0	31.4 ± 1.2	10.0 - 43.0
Distance to the nearest trail (m)	30.8 ± 2.4	9.0 - 100.0	21.3 ± 2.3	1.1 - 75.0
Distance to the nearest forest edge (m)	33.4 ± 4.0	0 - 120.0	42.5 ± 5.4	0 - 130.0
Tree density (stems/m^2)	0.15 ± 0.01	0.04 - 0.56	0.13 ± 0.02	0.01 - 0.75
Average DBH of trees (cm)	16.8 ± 0.6	7.5 - 31.0	15.3 ± 0.5	8.0 - 31.0
Tree cover (%)	32.2 ± 1.5	18.0 - 80.0	32.1 ± 1.8	15.0 - 86.0
Shrub cover (%)	40.0 ± 1.7	13.0 - 65.0	50.3 ± 2.3	10.0 - 85.0
Roosting tree DBH (cm)	27.3 ± 1.1	15.0 - 60.0	20.2 ± 0.7	15.0 - 40.0
The nearest tree DBH (cm)	15.0 ± 0.8	6.0 - 32.0	15.2 ± 0.8	7.0 - 32.0
Distance to the nearest tree (m)	1.3 ± 0.1	0.1 - 2.9	2.3 ± 0.2	0.1 - 10.0

[a]All habitat variables but "Distance to the nearest tree" were measured within the 10 × 10 m plot. DBH, diameter at breast height; S.E., standard error.

Table 2. Selection of macrohabitats for roosting by Buff-throated Partridges on Pamuling Mountain, Sichuan, China, 2006-2008

Macrohabitat (percentage)	Incubation period (n = 5 groups)		Early post-hatching period (n = 4 groups)		Other breeding periods (n = 13 groups)
	Female	Male	Female with chicks	Male	
FF (38.8%)	26	26	8	10	57
OT (49.5%)	0	0	2	0	1
RS (10.5%)	0	0	0	0	0
AM (1.2%)	0	0	0	0	0

FF, fir forests; OT, oak thickets; RS, rhododendron shrubs; AM, alpine meadows.

and logit link function; scores of habitat variables extracted from the PCA were included as factors in the models, and family group was used to a random factor. In the analysis, $p < 0.05$ was interpreted as being statistically significant, and means are presented as ± standard error (S.E.), unless otherwise stated.

RESULTS

Roosting behavior

Buff-throated Partridges were cooperative breeders in the study area, because partridge groups were frequently comprised of 1 female and multiple males (the mean size of groups excluding broods was 2.67 ± 0.16 birds, $n = 15$), and each group only had a single set of brood if it had any. Once a group formed and occupied an exclusive territory, the members foraged together during the daytime. At night, they huddled together on the same branch (height = 7.2 ± 0.2 m, diameter = 4.2 ± 0.1 cm, $n = 95$ observations from 13 groups) of *Abies squamata* or *Larix potaninii* (DBH = 27.3 ± 1.1 cm, $n = 58$ trees used by 13 groups), and individuals normally remained close to the tree trunk and were perpendicular to the branch 100% of the time, with their heads pointing downslope. Compared to a uniform distribution, the branches used were more frequently pointed in an easterly direction ($\chi^2 = 31.061$, $d.f. = 3$, $p < 0.001$, $n = 74$ observations from 13 groups, Fig. 2).

However, when females began to incubate eggs, males did not accompany them, and at night, the distance between males and females was 24.8 ± 2.4 m (range = 7.0-55.0 m, $n = 26$ observations from 5 groups). If eggs successfully hatched, females (with chicks) were joined by males during the day, but at night they were not accompanied by males until chicks were > 15 d old. Within this 2 wk period, because it was difficult for chicks to fly up into the tree, females brooded chicks under dense undergrowth (e.g., dense rhododendron shrubs, logs, and stumps, but not at old nest sites), or in *Q. aquifolioides* or *Rh. calophytum* thickets where the perching height was about 2 m above the ground, while males traveled 14.0 ± 2.4 m (range = 6.0-30.0 m, $n = 10$ observations from 4 groups) to return to their permanent roosting trees.

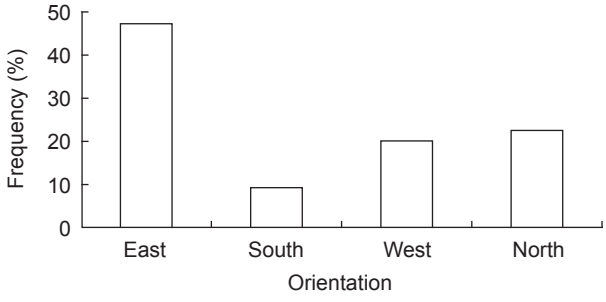

Fig. 2. Orientations ($n = 74$) of roost branches of Buff-throated Partridges on Pamuling Mountain, Sichuan, China, 2006-2008.

Roost selection

In total, 110 roosts were found (Fig. 1), some of which were repeatedly used. If repeatedly used roosts were not distinguished among the 3 periods of breeding, there would be 130 roosts, of which 52 were used during the incubation period (all of which were located in fir forests), 20 in the early post-hatching period (18 of which were located in fir forests), and 58 in the other breeding periods (57 of which were located in fir forests) (Table 2). It seemed that regardless of the period, Buff-throated Partridges almost exclusively used fir forests.

Of 58 roosting trees used during the other breeding periods, 41 were *A. squamata* and 17 were *L. potaninii*. The proportional use of these 2 tree species by Buff-throated Partridges did not differ from the expected ($\chi^2 = 0.081$, $d.f. = 1$, $p = 0.777$). The PCA of habitat variables yielded 4 components which collectively accounted for 67.73% of the total variance (Table 3). The 1st component (PC1) represented tree and shrub communities of the plots, with heavy loading by tree density (positive score), tree cover (positive score), average DBH of trees (negative score), and shrub cover (negative score). The 2nd (PC2) and 3rd components (PC3) mostly reflected physiographical characteristics or spatial positions of the target trees, with heavy loading by degree of slope (positive score), distance to the nearest forest edge (positive score), distance to the nearest trail (positive score), distance to the nearest tree (negative score), and the nearest tree DBH (positive score). The 4th component (PC4) was heavily loaded by roosting tree DBH (positive score), which defined vegetation features of the target trees.

The GLMMs showed that the probability of Buff-throated Partridges using a roost tree increased along PC2, PC3, and PC4 (Table 4), indicating that trees which were suitable for roosting by Buff-throated Partridges were large-DBH trees located in sites with large degree of slope, long distances to the nearest forest edge

(but this was contrary to our measurements, Table 1) and the nearest trail, and close to other large-DBH trees. Other components failed to enter the models.

DISCUSSION

Roosting behavior

Group members huddled together on the same branch when roosting. This is not known in other galliform species that roost in groups during the breeding season, the group members of which roost in neighboring trees (e.g., *Ithaginis cruentus*, Jia et al. 1999; *A. rufipectus*, Liao et al. 2008), or different branches even in the same tree (e.g., *Chrysolophus amherstiae*, Kang and Zheng 2007; *C. harmani*, Lu and Zheng 2007). Herein, we present 2 alternative, but not mutually exclusive, reasons for huddled roosting by Buff-throated Partridges: cooperative breeding and thermoregulatory benefits.

In our study area, Buff-throated Partridges were cooperative breeders. Skutch (1989) suggested that in cooperatively breeding birds, group members might be particularly prone to huddle together when roosting. The mechanisms for this, although not yet determined, are possibly associated with the specific life history of cooperatively breeding birds. Yet, further research is needed, because we found that *I. cruentus* was a cooperative breeder in the study area, but it was uncommon for this species to huddle together when roosting.

On cold days, diurnal birds can choose

Table 3. Factor loading, total and cumulative percent variance explained by the principal component analysis (Varimax normalized rotation) of habitat characteristics measured at the roosting tree scale of Buff-throated Partridges (n = 58). Factor loadings with absolute values ≥ 0.56 are shown in bold, based on our search for the highest absolute value for each factor

Habitat variable	Component			
	1	2	3	4
Degree of slope (°)	-0.029	**0.810**	0.051	0.155
Distance to the nearest trail (m)	0.267	0.241	**0.636**	-0.040
Distance to the nearest forest edge (m)	0.137	**0.608**	-0.202	-0.262
Tree density (stems/m^2)	**0.855**	0.303	0.151	0.136
Average DBH of trees (cm)	**-0.635**	-0.023	0.523	0.343
Tree cover (%)	**0.936**	0.034	-0.113	0.020
Shrub cover (%)	**-0.563**	-0.068	-0.053	-0.541
Roosting tree DBH (cm)	0.009	0.090	-0.058	**0.867**
The nearest tree DBH (cm)	-0.216	-0.136	**0.803**	-0.032
Distance to the nearest tree (m)	-0.185	**-0.570**	-0.161	-0.183
Eigenvalue	2.865	1.698	1.154	1.055
Percent (%) of variance	28.654	16.984	11.541	10.548
Cumulative percent (%)	28.654	45.637	57.178	67.726

DBH, diameter at breast height.

Table 4. Generalized linear mixed models (binomial error and logit link function) analyzing the probability of finding a Buff-throated Partridge roosting tree along 4 habitat gradients

Source	Estimate	± S.E.	*d.f.*	χ^2	*p*
Intercept	-0.078	0.270			
PC1	0.326	0.291	1, 99	1.26	0.265
PC2	1.752	0.399	1, 99	19.32	< 0.001
PC3	1.038	0.344	1, 99	9.12	0.003
PC4	2.163	0.439	1, 99	24.24	< 0.001

PC, principal component; S.E., standard error; *d.f.*, degree of freedom.

between reducing their activity to minimize heat loss and increasing it in the hope of generating higher heat production (Morse 1980, Doucette and Reebs 1994). Species that use the 1st strategy would have to adopt a particular roosting behavior (Morse 1980). In our study area, Buff-throated Partridges chose the 1st strategy when coping with cold days (Xu et al. 2008); thus, huddling while roosting may be a particular behavior creating a microclimate that ameliorates energy losses.

However, males did not roost close to incubating females. This behavior was also reported in other forest-dwelling galliform species, e.g., *I. cruentus* (Jia et al. 1999), *C. harmani* (Lu 1997), and *A. rufipectus* (Liao et al. 2008). Liao et al. (2008) suggested this was a strategy to reduce the possibility of nest predation. After all, huddling behavior may lead to greater conspicuousness of aggregating individuals to predators, and it would make a nest susceptible to predation, although adults can better protect them via mutual defense against predators (Alcock 2005). If eggs successfully hatched, male partridges' roosts were still not close to brooding females when chicks were < 15 d old, and this differs from *I. cruentus* (Jia et al. 1999) and *A. rufipectus* (Liao et al. 2008), in which males roosted in places very close to brooding females.

Roost selection

Buff-throated Partridges almost exclusively used fir forests, since the forests can provide high tree density, good canopy cover, and plenty of large-DBH trees (pers. observ.). Not only can fir forests provide Buff-throated Partridges protection from avian predators (e.g., *Gyps himalayensis* and *Strix aluco*), but more importantly provide thermoregulatory benefits in terms of reduced wind velocities (Eiserer 1984, Cody 1985) and reduced loss of long-wave radiation (Campbell and Norman 1998). Moisture-heat conditions in fir forests should also be better than those of other available macrohabitats, and decreases in air temperature are expected to be relatively slow at night.

Yet, in our study, high tree density, good canopy cover, and large average-DBH of trees did not successfully predict the probability of Buff-throated Partridges using a roosting tree as in other studies of forest-dwelling galliform species (see "Introduction"). As an explanation, we suggest that this is because both roosting trees and random trees occurred in areas with similar tree density, canopy cover, and average DBH of trees. It is possible that the sampling method, for which random trees were selected to be 100 m from the roosting trees, caused all forest measurements to be somewhat unbiased.

Nevertheless, trees in which Buff-throated Partridges roosted were predicted to have a large DBH and be located in sites with large degree of slope, long distance to the nearest trail, and close proximity to other large-DBH trees. Roosting trees had large DBHs and were located in sites with large degree of slope; these results are in agreement with the general view of forest-dwelling galliform species (see "Introduction"). Large-DBH trees provide spread-out canopies containing many nearly horizontal limbs for perching, also more easily allow birds to isolate themselves from ground-dwelling predators, and provide a better vantage point for predator detection prior to leaving the roost in the morning (Sweringin 2007). As members of the Galliformes are poor fliers, the choice of steep slopes makes it easier for individuals to escape threats and fly farther. As a matter of fact, it is not surprising that Buff-throated Partridges always roosted facing downslope, and often glided in a downslope direction when suddenly disturbed.

Few studies documented that the distance to the nearest trail was a significant predictor of roosting trees. Perhaps, for Buff-throated Partridges, a long distance to a trail is a result of a long-term process of natural selection of habitat, as in the past this species was highly hunted especially at night when it is easy for hunters to catch more individuals each time, due to their specific huddled roosting behavior.

On trees, groups often used easterly pointed branches, which allows individuals to receive the earliest morning light (Boeker and Scott 1969), and provides protection against the prevailing wind from the west (Rumble 1992). However, it is also possible that tree characteristics affect the directional selection of roosting branches, e.g., there may be thicker branches with an easterly orientation. Unfortunately, we have no data to indicate this was the case.

Relevance for management

We reported huddled roosting by Buff-throated Partridges during the breeding season, and suggested 2 possible mechanisms (cooperative breeding and thermoregulatory benefits) for this rare behavior in the Galliformes, which can be attributed to protection from harsh environmental

conditions. This rare behavior itself is of interest and worthy of conservation (Sutherland 1998).

Our study also showed that Buff-throated Partridges obviously selected roosting habitat, which has important consequences for thermal protection and predator avoidance. We acknowledge that the small sample size may limit the ability to generalize our conclusions. Further investigations, using more samples would be useful. Furthermore, it is suggested that random trees should be sampled further away (but they should still be constrained by the boundaries of the general macrohabitat and the territory), to try to make all forest measurements biased between sites where roosting and random trees occur.

We suggest a habitat management plan for the Buff-throated Partridge, based on the present results on roosting habitat selection. The government has been implementing reforestation programs within this species' distribution range, since commercial deforestation was prohibited with full implementation of a ban on logging in the upper Yangtze basin in 1998. However, to our knowledge, the selection of tree species used for reforestation is often made by considering the ease of growth, but lacking any ecological guidelines. In many areas of this species' distribution, only 1 or 2 tree species (e.g., *Pinus densata*) were planted. We suggest that forestry practices should include replanting fir forests preferred by Buff-throated Partridges, by planting *Abies squamata* and *Larix potaninii*. Furthermore, the exploitation of fir forests needs to be restrained; in particular, the logging of large-DBH *A. squamata* and *L. potaninii* located on sites with large degree of slope and long distance to the nearest trail should be avoided. The cutting of dense rhododendron shrubs or *Quercus aquifolioides* and *Rhodoendron calophytum* thickets should also be discouraged, as they are also important to the survival of females and chicks within the 1st 2 wks after hatching.

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