Study on Sleeping Sites Selection of Macaque Mulatta at Lu Mountain, Sichuan Province

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Abstract. Interview technique, field investigation and quadrat sampling method were used to study the sleeping sites selection by Macaque Mulatta in Lu Mountain, Sichuan Province. 5 sleeping sites selection were recorded in the investigation. 12 quadrates (10m*10m) and 15 habitat factors were measured and calculated with principal component analysis. The results showed that the characteristics of the sleeping sites were the area of 1600m-1700m, the middle slope position of slope land with slope of 20°-40°, certain macrophanerophytes density, the average DBH of the sleeping tree were less than 15 cm, the sleeping height were less than 6 m, the theropencedrymion with medium concealment, less disturbed human activities. The principal component analysis showed that the first 6 factors contributed 82.242% of the total variance reflecting the characters of the sleeping sites. It was indicated that the main ecological factors affecting the sleeping sites of the Macaca mulatta in Lu Mountain were terrain, sleeping height, feeding point distance, road distance, human interference distance, concealment, slope direction, etc.

1. Introduction
Sleeping sites are an important part of the habitat of wild animals, diurnal animals need to choose a suitable place to rest at night, while primate life activities spend half of their life stay in the sleeping sites, and the quality of sleeping sites is directly related to the size of wild animal population and the safety of animals at night [1]. Macaque mulatta belong to the monkey family, Macaca, which is a common monkey species in China and is classified as a national second-class protected animal, it is a vulnerable species. The macaque battalion has a semi-arboreal life, mostly habitat in cliffs, ravines and river banks dense forest or sparse forest rock mountain, groups, strong adaptability. Lu Mountain macaque population developed based on 101 wild Macaque mulatta captured and released here in Muli county, Liangshan prefecture in 1998. Domestic research on sleeping sites of primates focuses on Yunnan snub-nosed monkey [2-5], black langurs [6], etc., and it is rare to report on the sleeping sites of Macaque mulatta in scenic spots with intense human disturbance. This study aims to understand the characteristics of Macaque mulatta’ choice of sleeping sites in Sichuan Lu Mountain scenic spot, to understand the characteristics of the selection of Macaque mulatta' choice of sleeping sites in scenic areas, and to analyze the factors and basis affecting the choice of Macaque mulatta' choice of sleeping

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sites, it provides a scientific theoretical basis for the range of activity and night-sleeping behavior of Rhesus monkeys in Lu Mountain, as well as population dynamic distribution and research.

2. Research methods

2.1. Study locations and objects
Lu Mountain is located about 5km in the suburb of Xichang City, Liangshan Yi Autonomous Prefecture, Sichuan Province, adjacent to Qionghai Wetland. It is an important part of the Qionghai-Luoji Mountain Scenic Area. The top of the gauze cap of the main peak is 2317m above sea level and the area is about 46km². Affected by the alternation of southwest monsoon and southeast inland dry monsoon, it has the characteristics of subtropical plateau monsoon climate, rainy and humid in summer and warm and dry in winter. The light and heat resources are extremely abundant, the annual average temperature is 17.1°C, the annual average precipitation is 1000mm, and the annual sunshine duration can reach 2400h [7]. The vegetation types are mainly subtropical evergreen broad-leaved forests (mostly in the family Fagaceae, Lauraceae, Theaceae), and the coniferous forests are dominated by firs and Yunnan pines that were aerial sowing in the 1950s. These good natural conditions provide great convenience for the survival and reproduction of Macaque mulatta, and Lu Mountain Scenic Spot has a large number of tourists, and it also provides ample food and drinking water for the Lu Mountain macaque. The Macaque mulatta in the study area were developed from the original 101 wild Macaque mulatta introduced from Muli County, Sichuan Province to 500-600. Due to the increasingly tense relationship between human and monkey, after two captures and shunts, the number of Macaque mulatta in the Lu Mountain Mountains is about 150, and the population structure mainly young monkeys. Due to the large passenger flow in the scenic spot, the macaque has a large tolerance to human disturbance, and the tolerance distance can be reduced to 1 m.

2.2. Confirmation of sleeping sites
From February to May 2017, we investigated the selection of the sleeping sites for Lu Mountain Macaque mulatta, and determined the sleeping sites of Macaque mulatta by means of visiting method and field tracking method.

2.2.1. Access Method. Visit experienced security guards, rangers, vendors, and residents, and confirm the results based on observations and areas of suspected Macaque mulatta' sleeping sites, confirmation after field investigation

2.2.2. Field Tracking Method. According to the traces left by the activities of the monkey group (such as food residue, residual branch, feces, etc.) and when the monkey group are active, they will make a sound to identify the location of the activity [3], and the monkey group is tracked in real time. Until the evening, when the monkey group no longer moves significantly as a whole, the final place will be placed on the spot and marked, again the next day before dawn to confirm whether the monkey group is staying here.

2.3. Habitat survey of sleeping sites
To determine the selection mechanism of Lu Mountain Macaque mulatta for sleeping sites, especially the sleeping sites that the most concentrated trees for monkeys to sleep at night as the center set up 10m * 10m quadrat, and the terrain, measure and record habitat factor such as local terrain, vegetation type, altitude, slope direction, slope, slope position, tree density, coverage, average DBH of night-sleeping trees, night sleeping height, degree of concealment, water source distance, feeding point distance, human interference distance and road distance of each quadrat [8]. At the same time, five small quadrates of 1m*1m were randomly selected in the quadrat to determine the herbaceous layer coverage. Different measures were taken for different habitat factors. The definition and measurement of each habitat factor are as follows:
(1) Terrain: According to the spatial location of the sampling plot in the sleeping sites, it can be divided into hillside, ridge and gully.

(2) Vegetation type: According to different vegetation within the quadrat, it is divided into coniferous forest, broad-leaved forest and coniferous and broad-leaved mixed forest.

(3) Altitude: measured by GPS locator, divided into <1600m, ≥1600m.

(4) Slope direction: According to the slope direction of the quadrat, backward hillside, the division is determined by GPS locator, 46°-135° is east slope, 136°-225° is south slope, 226°-315° is West slope, 316°-360° and 0°-45° are the north slope.

(5) Slope: measured by a compass, divided into gentle slope (<20°), slope (20-40°), and steep slope (>40°).

(6) Slope position: when the sleeping sites are located on the hillside, it can be divided into upper, middle and lower slopes according to the sleeping sites.

(7) Density of macrophanerophytes: Number of trees with DBH greater than 10 cm in the quadrat is divided into <20cm, 20cm-40cm, and >40cm.

(8) Cover degree: it is divided into tree cover, shrub cover, and herb cover. According to the degree, it is divided into high (≥60%), medium (30%-60%), and low (≤30%).

(9) Average DBH of night-sleeping trees: The breast diameter of the night tree at 1.2 m from the ground is measured with a breast diameter ruler, and the average breast diameter of the night tree is calculated in the sample square. Divided into <15cm, ≥15cm.

(10) Sleeping height: measure the height of the sleeping habitat of the Macaque mulatta in the quadrat from the ground. It is divided into ≤6m and >6m.

(11) Concealment degree: The average visual distance measured to the surrounding area at the center of the sleeping sites is divided into high concealment degree (≤20m), medium concealment degree (20-50m), and low concealment degree (≥50m).

(12) Water source distance: Most of the water sources of the Lu Mountain Macaque mulatta are derived from mineral water and beverages provided by tourists. Therefore, the water source distance is calculated from the minimum distance between the quadrat and the most concentrated area of tourist activities, divided into <200m, 200m-400m, >400m.

(13) Feeding point distance: distance from the quadrat to the feeding point, divided into <200m, 200m-400m, >400m.

(14) Human interference distance: it reflects the degree of human disturbance in the scenic spot, such as tourist trails, vendors' booths, temples, residential houses, etc., the distance from the center of the quadrat to the nearest interference point, it is divided into severe interference (≤10m) and moderate interference (10m)-60m), mild interference (≥60m).

(15) Road distance: the distance between the sleeping sites quadrat and the nearest road, such as forest fire trails, tourist trails, and roads, is divided into <100m, ≥100m.

2.4. Data collection
According to the visit and field tracking, we searched for the monkeys through their sounds and activity traces (such as feces, food scraps, broken branches, etc.), and followed them in real time after finding them, until they entered the sleeping sites in the evening, and observed their chasing, roughing, screaming and mutual grooming after entering. Record the sleeping sites, record and observe many times, find different sleeping sites and usage, night stay behavior characteristics; or enter the study area in the early morning, according to the sound of the monkey group, arrive at the sleeping sites, observe and record, in order to record the rhesus monkey night stay and activity rules.

2.5. Data Analysis
Referring to Wei Fuwen and other Vanderloey and Scavia's selection coefficient Wi and selection index Ei as a measure of the habitat preference of the Macaque mulatta sleeping sites [9] formula is as follows: \( W_i = \frac{r_i}{p_i} \) / \( \sum r_i/p_i \) \( E_i = (W_i - 1/n) / (W_i + 1/n) \). Where Wi is the selection coefficient, i is the feature value, ri is the total number of environmental quadrant, pi is the number of quadrant with the
feature value i in the environment, n is the feature value index, and Ei is the selection index. When Ei=-1, it means not to choose, it is recorded as N; when -1<Ei<0, it means avoidance, which is recorded as NP; when Ei=0, it means random selection, denoted as R; when 0<Ei<1, it means like, it is recorded as P, and when Ei=1, it means that it is particularly like, and it is recorded as SP.

Use SPSS 20.0 software to verify that the data is in a normal distribution, and if so, paired sample t was used to test the habitat factors of the night quarters and non-night quarters. Principal component analysis, analysis of habitat factors such as altitude, slope direction, slope, macrophanerophytes density, coverage, Average DBH of night-sleeping trees, sleeping height, concealment, water source distance, feeding point distance and human disturbance, calculate the correlation matrix and the score vector to discuss the influence of habitat factors on the selection of sleeping sites and the contribution rate [7].

3. Results and analysis

3.1. Distribution and activity range of monkey groups' sleeping sites

Through visits and field investigations, it is found that the nights of the Lu Mountain Macaque mulatta are mainly distributed on the slopes of the slope land in eastern Lu Mountain (sunny slope) at an altitude of 1550m-1680m, from the Lu Mountain Mountain Gate-Liangshan Slavery Social Museum-Guangfu Temple-Gaun Bridge, this line is narrow and long, the vegetation types are coniferous and broad-leaved mixed forests, and the vegetation coverage and concealment degree are higher. The activity range of the Lu Mountain Macaque mulatta starts from the Liangshan Slave Social Museum and up to Guanyin Pavilion. The concentrated activity zone is a tourist footpath along the Guangfu Temple to Guanyin Pavilion.

3.2. Characteristics of sleeping sites

In the survey, a total of 5 sleeping sites were found, and 12 quadrates were set in it, and 15 habitat factors were measured and recorded (see Table 1). According to the preference of habitat selection, it can be seen that the selection characteristics of the Lu Mountain macaque's sleeping site are as follows: (1) prefer to choose a high-altitude zone with an altitude of between 1600m-1700m and avoid a single high altitude zone; (2) prefer to choose sleeping site in the mid-slope area of the slopes between 20° and 40°, avoiding gentle slopes and steep slopes; (3) prefer to choose medium concealment coniferous and broad-leaved mixed forest with a certain macrophanerophytes density, medium macrophanerophytes coverage, medium shrub coverage and medium herb coverage for sleeping at night, avoiding the sparse forest area with low or too high coverage to enhance the concealment of nights and nights to ensure the safety of nights; (4) prefer to choose trees with average DBH less than 15cm as the night tree, the sleeping height is more than ≤6m, avoiding the choice of more stout trees and higher places to stay overnight; (5) prefer to spend the night in places with less interference from human activities, but prefer to be close to areas where human activities are concentrated, so as to facilitate access to food and water.
### Table 1. Habitat factor selection coefficient and selection index of Lu Mountain macaque' sleeping site

| Project                              | i   | pi | Wi   | Ei   | Habitat selection |
|--------------------------------------|-----|----|------|------|-------------------|
| Terrain                              |     |    |      |      |                   |
| Hillside                             | 12  | 1  | 0.847| P    |                   |
| Ridge                                | 0   | 0  | 0    | R    |                   |
| Ravine                               | 0   | 0  | 0    | R    |                   |
| Vegetation Types                     |     |    |      |      |                   |
| Coniferous forest                    | 1   | 0.083 | -0.846 | NP  |                   |
| Broadleaf forest                     | 0   | 0  | 0    | R    |                   |
| Coniferous and broad-leaved mixed forest | 11  | 0.917 | 0.984 | P   |                   |
| Altitude                             |     |    |      |      |                   |
| <1600m                               | 3   | 0.25 | -0.143 | NP  |                   |
| ≥1600m                               | 9   | 0.75 | 0.742 | P    |                   |
| Slope direction                      |     |    |      |      |                   |
| East                                 | 12  | 1  | 0.847| P    |                   |
| South                                | 0   | 0  | 0    | R    |                   |
| West                                 | 0   | 0  | 0    | R    |                   |
| North                                | 0   | 0  | 0    | R    |                   |
| Slope                                |     |    |      |      |                   |
| <20°                                 | 2   | 0.167 | -0.5  | NP  |                   |
| 20°-40°                              | 9   | 0.75 | 0.742 | P    |                   |
| >40°                                 | 1   | 0.083 | -0.846 | NP  |                   |
| Slope position                       |     |    |      |      |                   |
| On                                   | 0   | 0  | 0    | R    |                   |
| Middle                               | 12  | 1  | 0.847| P    |                   |
| Under                                | 0   | 0  | 0    | R    |                   |
| macrophanerophytes density           |     |    |      |      |                   |
| <20                                  | 3   | 0.25 | -0.143 | NP  |                   |
| 20-40                                 | 8   | 0.667 | 0.608 | P    |                   |
| >40                                   | 1   | 0.083 | -0.846 | NP  |                   |
| Coverage                             |     |    |      |      |                   |
| macrophanerophytes coverage          |     |    |      |      |                   |
| <30                                  | 0   | 0  | 0    | R    |                   |
| 30-60                                 | 9   | 0.75 | 0.742 | P    |                   |
| >60                                  | 3   | 0.25 | -0.143 | NP  |                   |
| Shrub cover                          |     |    |      |      |                   |
| <30                                  | 0   | 0  | 0    | R    |                   |
| 30-60                                 | 12  | 1  | 0.847| P    |                   |
| >60                                  | 0   | 0  | 0    | R    |                   |
| Herbal coverage                      |     |    |      |      |                   |
| <30                                  | 7   | 0.583 | 0.606 | P    |                   |
| 30-60                                 | 5   | 0.417 | 0.352 | P    |                   |
| >60                                  | 0   | 0  | 0    | R    |                   |
| Average DBH of sleeping tree         |     |    |      |      |                   |
| <15cm                                | 9   | 0.75 | 0.742 | P    |                   |
| ≥15cm                                | 3   | 0.25 | -0.143 | NP  |                   |
| Sleeping height                      |     |    |      |      |                   |
| ≤5m                                  | 11  | 0.917 | 0.984 | P    |                   |
| >5m                                  | 1   | 0.083 | -0.846 | NP  |                   |
| Hidden degrees                       |     |    |      |      |                   |
| ≤20m                                 | 3   | 0.25 | -0.143 | NP  |                   |
| 20-50m                               | 8   | 0.667 | 0.608 | P    |                   |
| ≥50m                                 | 1   | 0.083 | -0.846 | NP  |                   |
| Water source distance                |     |    |      |      |                   |
| 100m-200m                            | 6   | 0.5  | 0.5  | P    |                   |
| >200m                                | 1   | 0.083 | -0.846 | NP  |                   |
| Feeding point distance               |     |    |      |      |                   |
| <200m                                | 2   | 0.167 | -0.5  | NP  |                   |
| 200m-400m                            | 7   | 0.583 | 0.606 | P    |                   |
| >400m                                | 3   | 0.25 | -0.143 | NP  |                   |
| Degree of human interference         |     |    |      |      |                   |
| Mild                                 | 8   | 0.667 | 0.684 | P    |                   |
| Moderate                             | 4   | 0.333 | 0.142 | P    |                   |
| Severe                               | 0   | 0  | 0    | R    |                   |
| Road distance                        |     |    |      |      |                   |
| <100m                                | 8   | 0.667 | 0.684 | P    |                   |
| ≥100m                                | 4   | 0.333 | 0.142 | P    |                   |
3.3. Principal component analysis of habitat factors in sleeping site

According to the analysis, Lu Mountain Macaque mulatta have a highly preference of 5.48m±0.62m for the place where they choose to sleep at night, (t=-15.386, p<0.01) the difference in tree height between the places where Lu Mountain Macaque mulatta choose to sleep at night and the places where they choose not to sleep at night is extremely significant; the average DBH of the sleeping tree was 13.40±1.19 (t=-4.125, p=0.002), and the herb coverage was 0.28±0.06 (t=2.930, p=0.014), the road distance is 86.83±54.33 (t=0.783, p=0.450), and the difference in average DBH of sleeping tree, macrophanerophytes coverage, herb cover and road distance between sleeping and non- sleeping sites is significant (0.01<p<0.05), the difference in altitude, slope, water distance and shrub coverage between sleeping and non-sleeping sites is not significant (p>0.05), thus, it can be known that the sleeping height, the average DBH of the sleeping tree, macrophanerophytes coverage, herbaceous coverage and road distance of Macaque mulatta in the habitat have a great influence on the choice of Macaque mulatta' sleeping site. The t-test values and characteristics (mean ± standard error) of the paired samples of Lu Mountain Macaque mulatta for sleeping and non- sleeping sites are shown in Table 2.

Table 2. The t-test values and characteristics (mean ± standard error) of the paired samples of Lu Mountain Macaque mulatta for sleeping and non- sleeping sites.

| Factor                        | Use quadrat group | Contrast quadrat group | T value | P value |
|-------------------------------|-------------------|------------------------|---------|---------|
| Slope                         | 29.67±7.61        | 24.67±7.36             | 1.417   | 0.184   |
| Macrophanerophytes coverage   | 0.56±0.06         | 0.42±0.09              | 4.237   | 0.001   |
| Shrub cover                   | 0.41±0.04         | 0.35±0.10              | 1.857   | 0.090   |
| Herbal coverage               | 0.28±0.06         | 0.20±0.06              | 2.930   | 0.014   |
| Average DBH of sleeping tree  | 13.40±1.19        | 21.08±6.37             | -4.125  | 0.002   |
| Sleeping height               | 5.48±0.62         | 20.25±3.08             | -15.386 | <0.01   |
| Water source distance         | 122.92±74.60      | 164.17±76.44           | -2.003  | 0.070   |
| Road distance                 | 86.83±54.33       | 67.58±41.97            | 0.783   | 0.450   |
| Altitude                      | 1628.47±36.67     | 1616.64±39.72          | 1.912   | 0.082   |

Table 3. The characteristic value table of the main components analysis of the Lu Mountain Macaque mulatta's sleeping site

| Principal component number | Characteristic root value | Contribution rate% | Cumulative contribution rate % |
|---------------------------|--------------------------|--------------------|-------------------------------|
| 1                         | 5.024                    | 27.911             | 27.911                        |
| 2                         | 2.863                    | 15.905             | 43.816                        |
| 3                         | 2.315                    | 12.864             | 56.680                        |
| 4                         | 1.848                    | 10.267             | 66.947                        |
| 5                         | 1.668                    | 9.268              | 75.216                        |
| 6                         | 1.085                    | 6.026              | 82.242                        |
| 7                         | 0.797                    | 4.427              | 86.669                        |
| 8                         | 0.735                    | 4.081              | 90.750                        |
| 9                         | 0.486                    | 2.698              | 93.448                        |
| 10                        | 0.369                    | 2.048              | 95.496                        |
| 11                        | 0.243                    | 1.349              | 96.845                        |
| 12                        | 0.219                    | 1.215              | 98.060                        |
| 13                        | 0.150                    | 0.831              | 98.891                        |
| 14                        | 0.109                    | 0.607              | 99.497                        |
| 15                        | 0.053                    | 0.307              | 10.000                        |

According to the principal component analysis of the habitat factors of the Lu Mountain Macaque mulatta's sleeping site can be concluded that: the first six habitat factors have a root value greater than
1, and the cumulative contribution rate is 82.242% (see Table 3), covering most of the sleeping habitat factors. Therefore, it is better to reflect the characteristics of the Lu Mountain Macaque mulatta's sleeping site, so the six main components are extracted to calculate the score matrix of the feature vector (see Table 4).

Table 4. Characteristic vector scoring matrix for the selection of the Lu Mountain Macaque mulatta's sleeping sites

| Variable                        | Feature vector |
|---------------------------------|----------------|
|                                 | 1  | 2     | 3    | 4     | 5    | 6    |
| Terrain                         | 0.874 | 0.220 | -0.024 | -0.063 | -0.011 | -0.256 |
| Vegetation Types                | 0.202 | 0.057 | -0.541 | 0.044 | 0.615 | 0.120 |
| Altitude                        | -0.084 | 0.897 | 0.031 | 0.141 | 0.125 | 0.048 |
| Slope direction                 | 0.049 | -0.023 | 0.232 | 0.012 | 0.743 | -0.072 |
| Slope                           | 0.581 | -0.075 | 0.307 | 0.344 | 0.392 | 0.281 |
| Slope position                  | 0.178 | 0.118 | 0.211 | 0.192 | 0.268 | 0.159 |
| macrophanerophytes density     | 0.588 | 0.378 | 0.045 | -0.236 | -0.206 | 0.485 |
| macrophanerophytes coverage    | 0.412 | 0.193 | -0.363 | 0.003 | -0.566 | 0.342 |
| Shrub cover                     | 0.441 | -0.277 | 0.269 | -0.090 | -0.684 | -0.081 |
| Herbal coverage                 | 0.537 | 0.453 | 0.388 | -0.232 | -0.061 | 0.382 |
| Average DBH of sleeping tree    | -0.800 | 0.013 | 0.196 | 0.113 | -0.064 | -0.321 |
| Sleeping height                 | -0.809 | -0.126 | 0.184 | 0.061 | 0.187 | -0.316 |
| Hidden degrees                  | 0.177 | 0.058 | 0.070 | -0.026 | 0.000 | 0.901 |
| Water source distance           | -0.356 | -0.692 | -0.125 | 0.144 | 0.061 | 0.000 |
| Feeding point distance          | -0.136 | -0.952 | 0.136 | -0.111 | 0.007 | -0.082 |
| Degree of human interference    | -0.003 | -0.019 | 0.837 | 0.129 | 0.111 | 0.056 |
| Road distance                   | 0.088 | -0.071 | -0.924 | -0.091 | -0.032 | -0.045 |

As can be seen from Table 3 and Table 4, the contribution rate of the first principal component reaches 27.911%, and the absolute values of the Terrain and sleeping height correlation coefficients are relatively large (0.874 and 0.809 respectively), and the two variables can provide a safe sleeping site for the Macaque mulatta. Therefore, the first component was named as a geographical factor; the contribution rate of the second principal component was 15.905%, the absolute value of the feeding point distance was larger (0.952), and it was named as a food factor; the contribution rate of the third and fourth principal components reached 23.131%, among which the absolute value of correlation coefficients of road distance and human disturbance distance were larger (0.924 and 0.837 respectively), so they were named as interference factors.; The contribution rate of the fifth and sixth principal components reached 15.294%, and the absolute values of the concealment degree and slope direction correlation coefficients are large (0.901 and 0.743 respectively), so they were named as the concealment factors. The above analysis can reflect the characteristics of the Lu Mountain Macaque mulatta's sleeping site, so the habitat factors affecting the sleeping site habitat of the Lu Mountain macaque are terrain, sleeping height, feeding point distance, road distance, human interference distance, concealment degree, aspect direction and so on.

4. Discussion

4.1. Distribution and utilization characteristics of the Lu Mountain Macaque mulatta's sleeping sites

Studies have shown that the Lu Mountain Macaque mulatta's sleeping sites are mostly distributed at the edge of their range of activities, and they are distributed in a strip shape. The main habitat factors of
each sleeping sites are similar, and the sleeping sites are relatively concentrated and fixed, basically not replaced. Mainly because the number of Macaque mulatta in Lu Mountain is small at present, and more young monkeys, it is not suitable for a wide range of long-distance running; However, there is a significant difference between Lu Mountain Macaque mulatta's sleeping sites and their activity area, from evening to early morning of the next day, Macaque mulatta choose the coniferous and broad-leaved mixed forest with a high degree of seclusion from human activities to rest. The high coniferous and broad-leaved mixed forest rests, while in the daytime, the regional activities in which human activities are concentrated are selected, which is different from the results of the study on the sleeping sites of Taihang mountain Macaque mulatta in Henan by Guo Xiangbao et al. [1]. Because the natural enemies of Macaque mulatta in the mountainous area are rare, it has become a habit to feed them artificially. Macaque mulatta have adapted to human activities in order to obtain sufficient food and water.

4.2. The relationship between the choices of the Lu Mountain Macaque mulatta's sleeping sites and the food factors
The food factor greatly affects the choice of the Lu Mountain Macaque mulatta's sleeping sites, and the sleeping site is mostly located in the forest area close to the feeding place of rhesus monkeys in Lu Mountain scenic spot (100m northeast of Guangfu Temple), to shorten the feeding time and reduce energy consumption are similar to those of Jin Chaoguang et al [5] on black-and-white nose monkeys. Through the investigation of the vegetation in Lusha, there are fewer plants for feeding Macaque mulatta, a Moreover, due to the restoration of vegetation by converting farmland to forestry, there are fewer farming areas around Lu Mountain, and the natural food sources of Lu Mountain Macaque mulatta are scarce. Staff of Lu Mountain scenic area management office regularly feed corn every morning, and tourists habitually feed peanuts and crisps and other food, so Lu Mountain Macaque mulatta depend on human feeding to a large extent, and choose sleeping sites close to the feeding point and the concentration area of human activities. This is quite different from that of Yunnan snub-nosed monkeys in Xiangguqing, which were studied by He Xinming et al. [3], the main food source of Yunnan snub-nosed monkeys is deciduous broad-leaved forest.

4.3. The influence of habitat factors on the choice of Lu Mountain Macaque mulatta's sleeping sites
The Lu Mountain Macaque mulatta's sleeping sites prefer to choose a coniferous and broad-leaved mixed forest with a certain slope at an altitude of about 1700m. The density of macrophanerophytes in the sleeping sites is higher and the medium coverage is moderate, and the concealment conditions are moderate. The sleeping sites are located on the sunny slope, with altitude and light and heat conditions, and the vegetation is rich. This is similar to the Taihang Mountain macaque [10]; The Lu Mountain Macaque mulatta choose a certain slope of the sleeping sites, effectively defending against natural enemies, not easy to accumulate water, and can obtain a dry and comfortable environment for sleeping sites; Better vegetation coverage of certain macrophanerophytes density, coverage and concealment, not only can improve the concealment of sleeping sites, but also to some extent resist strong winds, heavy rain, hot sun, strong winds and other unfavorable natural conditions, which is similar to Guo Xiangbao's research results [1]; Lu Mountain Macaque mulatta's sleeping sites is close to human activity concentration area and road, mainly because Lu Mountain lacks natural water source distribution, so it is more convenient for Macaque mulatta to find drinking water source and get food from tourists if they choose to stay close to human activity area.

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