Habitat Status and Conservation Threats of the Red Panda in Jigme Singye Wangchuck National Park

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Abstract

The study was carried out in Jigme Singye Wangchuck National Park, the 3rd largest protected area in the country. The objectives of study were to document habitat type, list down the bamboo species and document conservation threats to the red panda. The data was collected by using GRADSECT or Gradient oriented transects (altitudinal rise or fall). The direction and distance of plot from transect were selected through randomly generated number. The 10 m radius circular plots were taken for vegetation composition and intensity of human disturbances. The 5mx5m within 10 m radius circular plot was taken for shrubs and bamboo. The sampling method used was stratified random sampling.

The results also showed that the Red panda prefer mostly mixed conifer forest over those of cool broadleaved forest and blue pine forest. The mixed conifer forest was dominated by *Abies densa, Tsuga domosa, Acer campbellii* with *Symplocos sp, Rhododendron sp(s), Daphene bholua* and bamboo undergrowth. The presence signs of Red panda were observed within 400m from water sources and on north and north-east aspect. The bamboo species found in the study site were *Borinda grossa, Arundinaria racemosa, Yushiana pantilingii* and *Yushiana micriphylla.* The results showed that maximum presence signs were observed in *Borinda grossa and Arundinaria racemosa*.

The conservation natural threats observed were bamboos flowering and presence of wild predators. The grazing, harvesting of timber and bamboo collection were anthropogenic threats. Further research, awareness programs on important of its role in the ecosystem, categorization of habitat into different zones for effective monitoring system are recommended.

Key-words: Habitat status, bamboo species, presence and absence, Red panda, JSWNP.

Introduction

Red panda is a unique carnivore that has adapted to the herbivore mode of life and is a resident of Himalayan mountain ranges (Yonzon & Hunter., 1991). Like its phylogenetic position, status of the red panda in wild has also been a matter of great discussion and speculation for over a long period (Wei & Zhang., 2011). But IUCN has reassessed the global status of red panda and placed it under the vulnerable category and they presume that the global number of red panda across its range - spanning from Nepal to Sichuan province of China through India, Bhutan and Myanmar, could number to 10,000 individuals (Pradhan S.et al., 2001; Wei & Zhang., 2011). In Bhutan too, though red panda is included under the Schedule - I of Forest and Nature Conservation Act of Bhutan 1995, very little is known about its habitat status and conservation threats in the wild. It is essential to have a baseline data and information of the species to adopt and understand the specific conservation programs. To date, no studies have been conducted on red panda in any area under JSWNP. The habitat status and conservation threats study was found crucial and timely. The sampling method used was stratified random sampling.

Methodology

Study Area (Description of the research site)

The Jigme Singye Wangchuck National Park (JSWNP) was selected for the study site outstanding that presence of the red panda was known and the area was logistically feasible for the research purpose. The study area, JSWNP falls within the administrative jurisdiction of five districts Wangdi, Trongsa, Zhemgang, Sarpang and Tsirang and has an area of 1730 sq km. The study site had 10 blocks and inhabited by over 613 households and more than 5000 people. Most people in the study site practice subsistence agriculture and also rear few livestock.

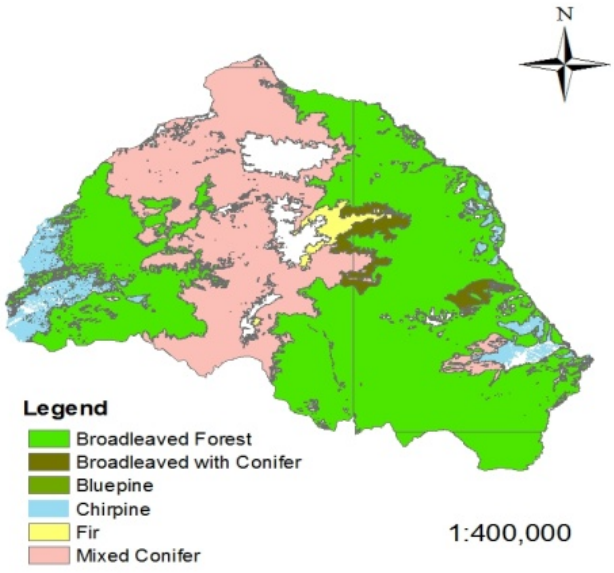


Figure 1. Map of study area

The forest type was dominated by Cool Broadleaved Forest at lower altitude and by Mixed Conifer Forest and Fir Forest at higher altitude. The topography of study area is mostly rugged in most areas. The rainfall in the area occurs during June-August. The climate is cold in winter and moderate in summer months.

Research Design

The terrain of study site is very steep and rugged. It was not possible to deploy random sampling point due to accessibility problems. Therefore, stratified random sampling combined with randomized line transect was adopted using the accessible area and existing trails. The informal interview with the local communities was conducted on the presence or absence of red panda and their existing conservation threats. The secondary data like number of households, population, cattle population and any other related information was gathered from geog center. During the research two types of field data were collected in, one was land cover plot with habitat parameter and the other was presence or absence of red panda through indirect evidences. Some basic equipment like Global Positioning System (Garmin GPS), altimeter, measuring tape, sunto compass and digital camera were used for data collection in the field.

Field Method

Counting absolute numbers of most of the wildlife species is extremely costly in terms of time, labor and money, and was impossible in several cases. The red pandas were difficult to encounter as they are nocturnal, arboreal and shy (Pradhan et al., 2001 and Wei et al., 2000). Instead, evidences like pellets and feeding signs were used to document presence or absence model as they were easier to find.

Therefore, this study was totally based on the indirect evidences of red panda 'pellet count' and feeding signs on bamboo. The sighting of any animal was considered equally important. In the stratified random samples, GRADSECT or Gradient oriented transects (i.e. rise or fall in altitude) was deployed at interval of every 50 meter rise or fall of altitude. The direction and distance of plot were selected based on randomly generated number (Microsoft excel) 1-150m for distance and 1-360° for direction. The 10 m radius circular plot was taken to determine the composition

and structure of vegetation, and type and intensity of human disturbances in the study area. The information on bamboo and regeneration were collected from randomly placed 5mx5m plot within the 10m radius plot.

Data Analysis

Data was statistically analyzed using the Statistical Package for Social Sciences (SPSS) Version 16 and Microsoft Excel spreadsheet. Data were coded and synthesized for analysis. Both descriptive and inferential statistics were used to analyze the data. Descriptive analysis was used to find out the mean, standard deviation, maximum and minimum of variables like; altitude, slope, tree species, bamboo species and others. Comparative and association analysis between variables was performed by using correlation to see relation between altitude and bamboo occurrence, tree GBH and bamboo cover, altitude and diversity of tree species.

The Microsoft Excel Sheet was used to find importance value index, Simpson's 'D' and Shannon's 'H'. The importance value index was used to calculate or estimate the influence of importance of a plant species in the community. This would facilitate to determine the habitat preference of the red panda.

Results and Discussion

The total of 100 numbers of 10 m radius circular plot were surveyed. Out of total plots, 50% *(n= 50)* plots were in mixed conifer, 38% *(n=38)* in cold broadleaved and 12% *(n=12)* were in pure Blue pine forest. The mean altitude of the study area was 2640.50 m asl (SD=±187.64) and the mean of the slope was 24.72° (SD=±9.825).

Habitat type

Vegetation composition

Amongst seven transect lines, the highest tree species was recorded in transect five, 22% (n=9), 19% *(n=8)* species in transect four and six and least number of tree species 5% *(n=2)* recorded in transect seven. The highest basal area was recorded 129692.20 sq cm in transect five, 106711.31 sq cm in transect six, 79830.57sq cm in transect seven and 69382.25 sq cm in transect one. The Shannon's H' diversity was recorded highest in transect four and the Simpson's D' dominance was recorded highest in transect six.

The total of 18 tree species were recorded in seven transect lines. The most common individual was *Abies densa 26.7% (n=70), Tsuga domosa* 20.9% *(n=65),* followed by *Pinus wallichiana* 15.9% *(=54), Quercus semecarpifolia* 12.30% *(n=36), Persea charkeana 6*.40% *(n=21), Betutal alnoides* 7% *(n=20), Rhododendron arboreium* 6.20% *(n=18),* and *Magnolia campbellii* 3% *(n=10)* respectively. The most little recorded tree species was s*ymplocos ramosissima* 0.40% *(n=1).*

The total of 19 species of shrubs were recorded in plots along all transects. The *Symplocos ramosissima* was most common individual 21% *(n=24),* followed by *Eurya acuminata* 14%, *(n=16) Daphne bholua* 11% *(n=13) Rhododendron arboretum* 9% *(n=11)* and *Berberis mucrifolia* 9% *(n=10.* The *Sarcococca wallichii* 1% *(n=1), Gaulteria sp* 1% *(n=1)* and *Cinnamomum sp* 1% *(n=1)* were least recorded shrubs species in all transects.

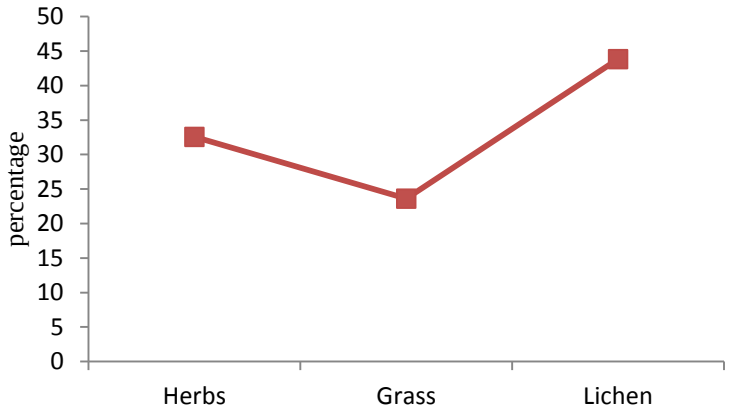
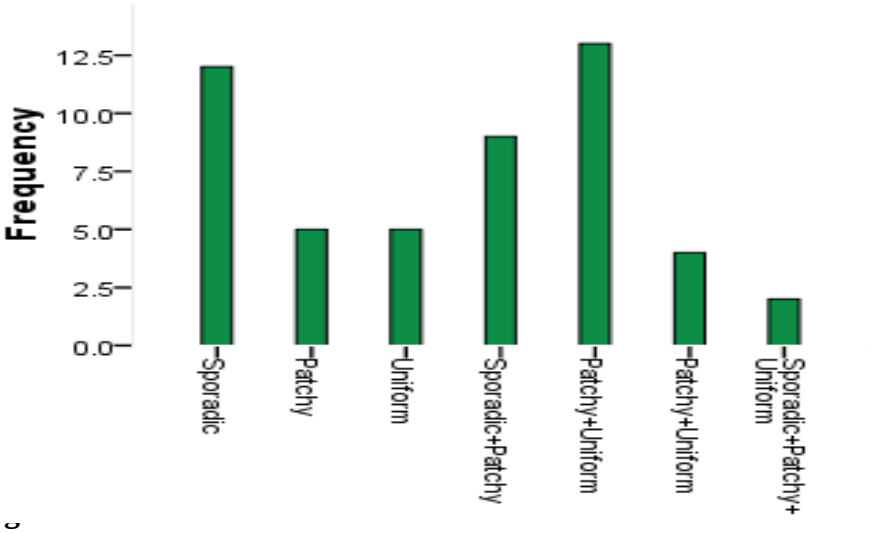


Figure 2. Percentage of ground cover



The frequency of Lichen was recorded highest in all transects 44% *(n=39)*, Herbs 33% *(n=29)* and Grass 24% *(n=21)*. (Figure 2) The distribution of ground cover or understory was mostly recorded patchy + uniform 26% *(n=13)*, followed by sporadic 24% *(n=12)*, sporadic + patchy 18% *(n=9)*, patchy and uniform 10% *(n=10)* and patchy + uniform 4% *(n=2)* (Figure 3).

Vegetation Structure

Vegetation structure variation was observed very less amongst all seven transect lines. The tree density was highest in transect seven 215 trees per hectare, followed by 186 trees per hectare in transect two, 177 trees per hectare in transect six, 163 trees per hectare in transect five, 138 trees per hectare each in transect one and three and the transect four had the lowest tree density, 127 trees per hectare (Figure 4). The transect number seven was recorded with highest tree density as it was dominated by *Tsuga domosa* and *Quercus semecarpifolia* species.

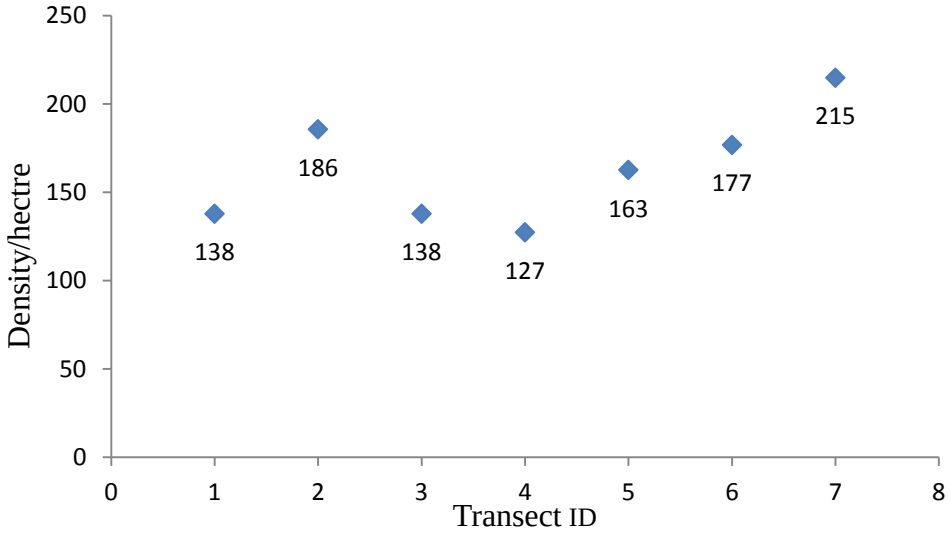


Figure 4. Transect wise tree density per hectare

The average tree height varies from transect to transect. The mean of average tree height was 25.93 m (SD=±5.29). The maximum average tree height was recorded in transect one 34.05 m followed by transect seven 31.76 m, transect six 26.43 m, transect three 25.21 m, transect two 22.53, transect five 21.76 m and least average height was recorded in transect four 19.75 m (Figure 5). The results were as transects one and seven had matured forest of blue pine, mixed conifer and *Quercus semecarpifolia* dominated cool broadleaved.

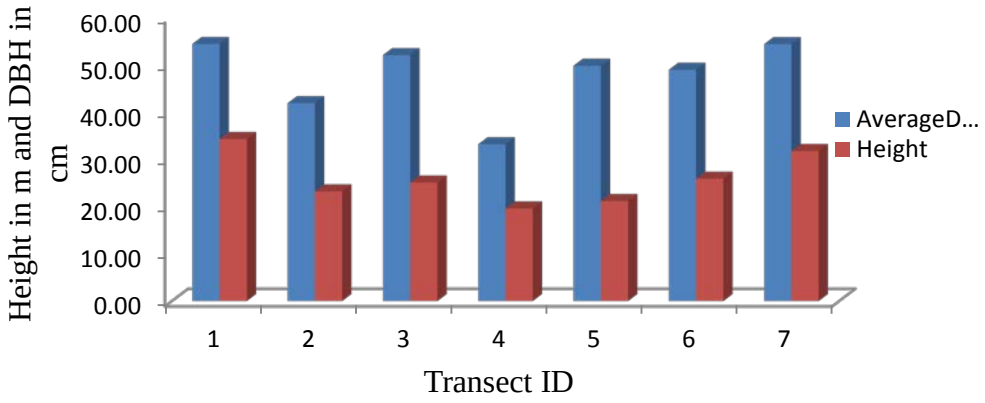


Figure 5. Transect wise tree height and DBH

The average mean DBH of the tree in all transect was 47.78 cm (SD=±7.34). The highest average tree DBH was recorded 54.37 cm in transect one followed by 54.35 cm in transect seven, 52.02 cm in transect three, 49.78 cm in transect five, 48.93 cm in transect six, 41.86 in transect two and 33.17 cm in transect four (Figure 5). The results were resulted as transects one and seven had matured forest of blue pine, mixed conifer and *Quercus semecarpifolia* dominated cool broadleaved.

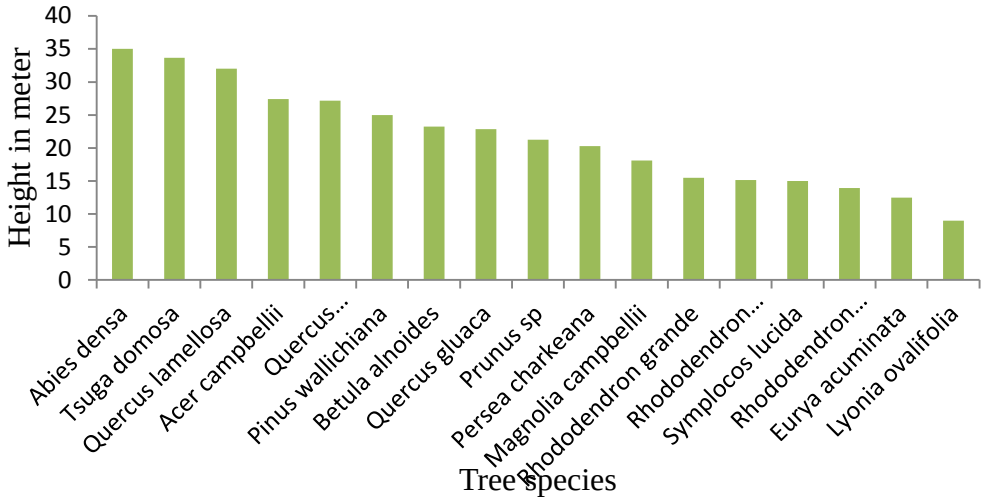


Figure 6. Individual tree height

The average mean height of individual tree species was 21.59 m (SD=±7.71). The tallest individual tree species was *Abies densa* 35 m followed by *Tsuga domosa* 33.65 m, Quercus lamellosa 32 m, *Acer campbellii* 27.42 m, *Quercus semecarpifolia* 27.18 m, *Pinus wallichiana* 24.98 m, *Betula alnoides* 23.23 m and shorted tree species was *Lyonia ovalifolia* 9 m (Figure 6).

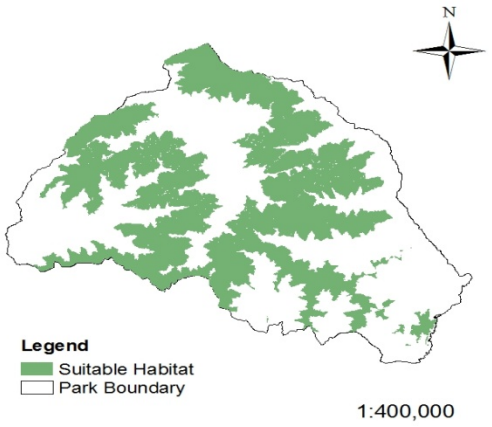
There was weak negative association between altitude and tree GBH and height; r (48) =-.08, $p \leq .01$, r (48) =-.24, $p \leq .01$.

The *Tsuga domosa* was most dominant tree species and had highest of all relative density 25.9, relative dominance 48.83, relative frequency 22.22 and important value index 96.95. The least recorded tree species was *Symplocos ramosissima* with relative density 0.4, relative dominance .0.116, relative frequency 1.01, important value index 1.525 followed by A*bies densa* with relative density 0.4, relative dominance 0.4, relative frequency 1.01 and important value 1.88. This had resulted as *Tsuga domosa* was recorded as highest individual tree species in the study area.

The average mean height of shrubs was 2.13 m (SD=±1.12) and average cover percentage was 7.04% (SD=±3.45). The *Rhododendron fulgens* was recorded as the tallest shrubs species 4 m, followed by *Lyonia ovalifolia* 3.9 m, *Quercus semecarpifolia* 3.17 m, *Symplocos ramosissima* 3.02 m and shortest shrubs species was *Cotonester sp* 0.50 m. The *Rhododendron kesangiae* was recorded with highest cover percentage 17.71%, followed by *Gaultheria fragratissima* 11%, *Rhododendron arboretum* 10.82 %, *Smilax sp* 9.33%, *Rhododendron berbatum* 8.33%, *Symplocos ramosissima* 7% and least was *Quercus lamellosa* 3.5%. The *Rhododendron sp* (s) had by nature adopted taller and widest growth in comparison to other shrub species but *Quercus semecarpifolia* was in sapling stages. The *Cotonester sp* was recorded as shortest shrub as it grows by creeping on the ground.

Bamboo Composition, Structure and Mapping

From the total area of 1730 sq km 45.5% *(n=788)* sq km (Figure 7) was potential area for bamboo and was least covered by one of the four bamboo species. The *Arundinaria racemosa* was recorded in 32% *(n=32),* of the total plots followed by *Borinda grossa* 28% *(n=28), Yushiana pantilingii* 20% *(n=20)* and *Yushiana microphylla* 14% *(n=14).* The *Arundinaria racemosa and Borinda grossa* was found



at mean altitude of 2703 m asl (SD=±204), *Yushiana pantilingii* at mean altitude of 2620 m asl (SD=±262) and mean altitude where *Yushiana microphylla* recorded was 2644 m asl (SD=±83). The *Yushinia pantilingii* was recorded for highest density 18926 individual per hectare, followed by *Arundinaria racemosa* 17560 per hectare, *Borinda grossa* 16985 individual per hectare and *Yushinia microphylla* 14468 individual per hectare. The average height of *Borinda grossa* was 7.33 m, followed by *Arundinaria racemosa* 6.45 m, *Yushinia pantilingii* 2.7 m and *Yushinia microphylla* 0.67 m. The cover percentage was dominated by *Arundinaria racemosa 35% Borinda grossa* 30%, *Yushinia pantilingii* 20% and *Yushinia microphylla* 15%. As per finding of this research the bamboo occurrence was not affected either by distance from water or aspect of the study area. The *Yushiana pantilingii* was thinner in girth in comparison to *Arundinaria racemosa* and *Borinda grossa* and *Yushiana microphylla* were recorded in open areas. This had resulted *Yushiana pantilingii* with higher density.

There was negative medium association between both tree GBH and tree height with number of bamboo r (48) =-.39, p <.01, r (48) =-.45, p < .01.

Conservation Threats

Natural threats

Bamboo exhibits what is known as gregarious flowering. All plants in a grove will flower simultaneously, regardless of outside conditions that may be present. This mass flowering is likely connected with vegetative propagation, the way in which bamboo spreads both in the wild and in human cultivation. Timing is likely programmed into the plants genetic structure, causing all plants to flower within the exact same timeframe.

This gregarious flower hit study area in 2010 and caused partial or complete dead to all three species of bamboo. As the bamboo is chief part of the diet, flowering had threatened the red panda with food security (Figure 14 and 15).

Figure 14. Results of flowering

Figure 15. Results of flowering

The plots which were recorded with absence evidences of Red panda was 66.66% *(n=66)* plots and found all bamboo species and individual observed dead in 100% *(n=66)* plots (Figure 14 and 15).

The existence of wild predators in same habitat is another natural threat to the Red panda. Out seven transect lines, 71 % *(n=5)* transects was recorded with either Tiger or Leopard presence signs. The mean altitude where natural predators presence was 2787 m asl (SD=±238).

Anthropogenic Threats

The anthropogenic disturbances were observed in 34% *(n=34)* plots of the total 100 plots surveyed in seven different transect line. The human presence signs, grazing by livestock, forest products harvest and cattle dung was recorded as main threats and disturbances.

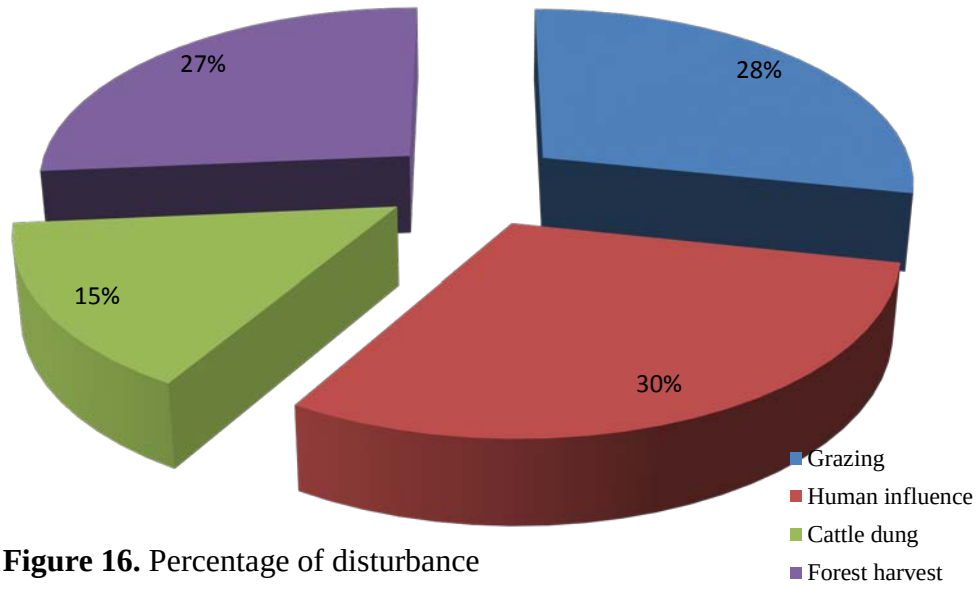


Figure 16. Percentage of disturbance

The out of 53 disturbance counts, 30% *(n=16)* was human influence or signs of human visits, 28% *(n=15)* was grazing, harvest of forest products 27% *(n=14)* and cattle dung 15% *(n=8)* (Figure 16). There was also bur collection evidences along transect line three and four at the point where Red panda signs were recorded. The bur collectors may poise threats through disturbance and chances of poaching.

The through semi-structured questionnaires survey it is been revealed that only 22% *(n=5)* stated Red panda population is stable, 17% *(n=4)* stated population is declining and 61% *(n=14)*

(Figure 17) have no information which means they don't understand anything about the red panda and could do anything to harm them.

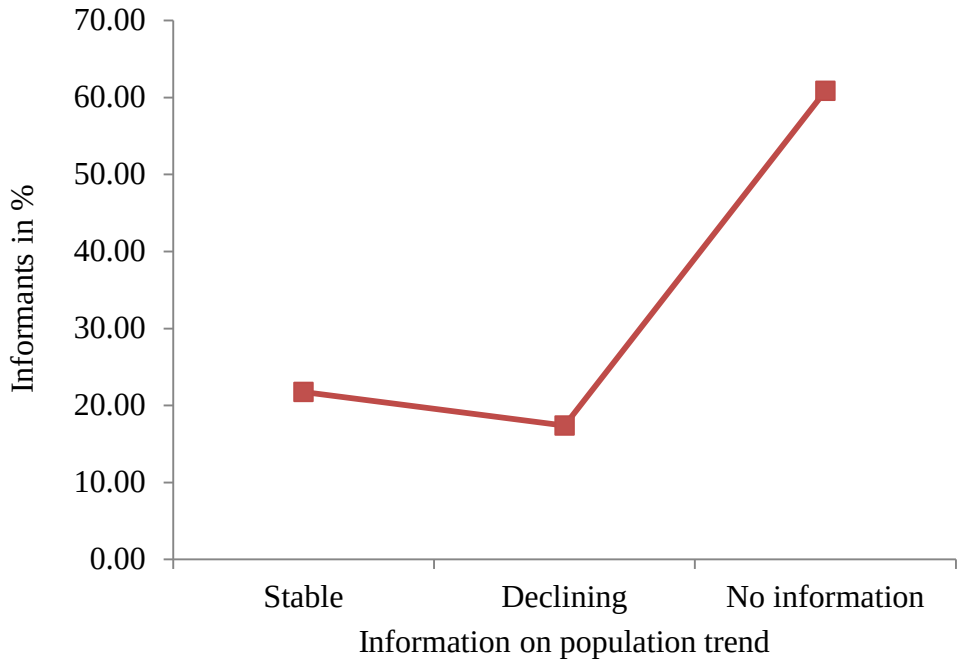


Figure 17. Red panda population trends

It was also reported that by 4.35% *(n=1)* interviewee one red panda was accidentally killed in the study area within last 5 years.

All 42 households collect bamboo for fencing agricultural land and roofing their cattle shed. The average or mean in number collected by individual household per year was 75 pieces (SD=±35.35). The bamboo species include *Arundinaria racemosa, Borinda grossa* and *Yushiana pantilingii* utilized by the Red panda and constitutes a high-level threat to the species. In addition local community had mean cattle head of 12 numbers (SD±11.31), around 10 months they free graze their cattle in the forest. The grazing caused competition for food and damage bamboo re-generation. Excessive grazing in conifer forest can also further reduce the regeneration of seed-lings particularly of fir, hemlock and juniper, which are important to the Red panda. The local

communities harvest at least one tree per year and total up to minimum of 42 trees per year from eastern side of the study area. The collections were 100% from the study area and caused disturbance and damage to red panda and its' habitat.

Conclusion

The habitats available for the Red panda in the study site were Fir forest, mixed conifer forest, cool broadleaved forest and blue pine forest. The dominant tree species in Fir forest is *Abies densa, Tsguga domosa* in mixed conifer forest, *Quercus semecarpifolia* was dominatnt tree in cool broadleaved forest and blue pine forest was dominated by *Pinus wallichiana.* The most frequented or available shrubs species were *Symplocos ramosissima, Eurya acuminata, Daphne bholua and Rhododendron arboreium* respectively. The lichen had highest cover percentage and observed in association with both herb and grass. This study found that the Red panda prefer Fir forest and mixed conifer forest most over those of cool broadleaved forest and blue pine forest. The distance from the water sources were recorded from 30 m to 400 m. The variation of altitude didn't make much differences in encountering evidences as lowest plot was already above expect habitat range. Instead of easterly and southerly aspect (found out from previous study) during this study more evidences were found on north and north-east aspect.

Bamboo plants are integral part of Red panda habitat as a food and consist more than 80% of their diet composition. Despite of different forest type bamboo were found equally available in all three types of forest. In the study site *Arundinaria racemosa and Borinda grossa* was found at wide range of altitude. The *Yushiana microphylla* was more or less restricted to open area. The *Yushiana pintilingii* share similar micro-habitat but do not in-habitat as high as *Borinda grossa*. Though the bamboo is chief part of the red panda diet, gregarious flowering occurred from year 2010 had caused few or complete dead to all four species. The *Arundinaria racemosa* and *Borin-*

da grossa was hard hit and only very few individuals were found green. But regeneration had started at higher elevation and higher the evaluation taller the seedlings were found and ranges from 30 cm to 1m in height. The *Yushiana pintilingii* was hit second in term of severity and found green individuals in few patches. Currently, the *Yushiana microphylla* would substitute other two species as it was less affected by gregarious flowering. However, after 2-3 years *Arundinaria racemosa* and *Borinda grossa* regeneration would cover its entire existing habitat and the red panda would have plenty of lush green palatable young leave to feed on.

The conservation threats on Red panda were of two types; the natural and anthropogenic threats. The current natural conservation threat was gregarious flowering of the bamboo. The gregarious flowering didn't have selection among species or amongst individuals. The dead occurred to all species of bamboo and the exception was just time frame, it varied from individuals to individuals and species to species. The event of the bamboo flowering had definitely caused food scarcity to the Red panda resulting forced displacement of their existence from the area or starved to dead. Another natural conservation threat was wild predators. The study site was known for the presence of Clouded leopard the deadliest predator of the red panda. Through this study it was also found that top predators of Bhutan both Tiger and Leopard co-share habitat with the red panda. The presence of all above predators caused threats to the red panda conservation.

The anthropogenic conservation threats were posed by the presence of human being's activities in and around the red panda habitat. In the study site, free cattle grazing in the caused food competition, habitat destruction and disturbances. The timber harvesting and bamboo collection by all 42 household of Chendebji village was annual event. The timber harvesting and bamboo collection sites were from habitat of the red panda. By those activities the red panda habitat is been damaged and destroyed and pose severe conservation threats.

Recommendation

The Red panda is very timid or illusive animal which require lots of time and resources to do proper study. In contrast to above statement, this research was time bound with limited resources. To obtain reliable and the best result on the red panda presence and absence and its habitat status, I would recommend that any person taking up study/research should at least plan field works for the period of atleast three years for study size of Jigme Singye Wangchuck National Park. This is been recommended to search the entire study area thoroughly for signs and evidences of the red panda to avoid faulty findings and interpretation of the actual result.

The awareness on the red panda in the study area was restricted to the older section of the local community. Therefore, I would recommend conducting awareness on important of the red panda and its role in ecosystem at least ones in a year for successful conservation.

For proper monitoring of the red panda, habitat should be categories into different zones stating intensity of presence signs and accordingly preference for monitoring should be given to more intense zones.

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