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Selection of Red Panda (*Ailurus fulgens*) as an indicator species in Singalila National Park, Darjeeling, India

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ABSTRACT

Indicator species is an organism which indicates the condition of the environment or response to stress that is inconvenient or expensive to measure and the population density, presence/absence, reproduction success and migration of the species may be used as an index of attribute. It is mainly use to assess environmental condition as an early warning of the problem and the ecological changes occurring in the nature. In this study, effort has been made to consider red panda (*Ailurus fulgens*) as indicator species in the Singalila National Park, Darjeeling, India. Red panda is an endangered, charismatic carnivore which has converted into herbivore mode of diet. It is found in Himalayan and Hengduan mountain ranges mainly at the temperate conifer and the adjacent broad leaf forest with mainly bamboo dominance within the altitude of 1500m and 4800m above sea level. Anthropogenic pressure and rising human population is damaging the health of ecosystem and creating pressure on forest. Red panda is a solitary and shy animal and respond actively to the anthropogenic stress. Being a flagship, priority species and endemic to the region, red panda can be considered as an indicator species to monitor the ecological integrity and anthropogenic disturbance in the Singalila National Park, Darjeeling.

Key word : *Red panda, Indicator species, Singalila National Park*

Introduction

Indicator species is a living organism that can be easily monitored and their status reflects the condition of the environment where they are found (Landers, 1988; Cairns, 1993; Markert *et al.,* 1999; Bartell, 2006; Burger, 2006; Siddig, 2016). Response of the indicator species to a particular stress represents for the community in the ecosystem. They are sensitive to pollution, habitat fragmentation or other stress. Indicator species are developed by the researcher, scientist and managers that focus on the important facet of ecosystem which are essential for the assessment of the ecological condition (Niemi, 2004). The use of indicator species to evaluate and monitor the environmental condition is an established tradition in ecology, environmental toxicology, pollution control, agriculture, forestry and wildlife. Using indicator species to monitor and evaluate the environmental impact on animals and plants is one of the most easy and cheaper way (Noss, 1990; Lien 2007). Hall (1919) was the first person to use the concept of indicator species by associating plant and animal species to particular life zone (large geographic area with similar structure and compositional characteristics) (Carignan, 2001). According to Carignan (2001) the use of indicator species has been incorporated in the policies

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and regulation in order to monitor the ecological integrity of watersheds (Moyle, 1998), lakes (Karr, 1981; Harig, 1998), Semi natural pastures (Part, 1999 a,b), rangeland (Bradford *et al*., 1998) and forest (Brooks *et al.,* 1998).

Red panda is an endangered, solitary and scansorial carnivore species of Himalayan and Hengduan mountain ranges which has adapted to herbivore diet (Roberts, 1984; Glatston, 1994; Wei *et al.,* 1999; Choudhury, 2001; Pradhan, 2001; Li *et al*., 2005; Hu *et al*., 2011; Roka, 2014; Kumar, 2015; Roka, 2018). The habitat distribution of the animal ranges from the Himalayan belt of Nepal, India, Bhutan, Myanmar and through the Minshan Mountains and upper Min Valley of Sichuan Province in south-central China (Glatston, 1994; Chaudhary, 2001; Wang *et al*., 2008; Dorji, 2011; Roka, 2018). Red panda is mainly found in the temperate conifer and the adjacent broadleaf forest with maling bamboo dominance within the altitude of 1500 m and 4800 m (Prater, 1988; Catton, 1990; Yonzon, 1991; Pradhan, 2001; Chaudhury, 2001; Panthi, 2012; Kumar, 2016; Roka 2018). Red panda is listed in Appendix I of the Convention on International Trade for Endangered Species of wild fauna and flora (CITES) and in India red panda is included under the Schedule - I of Indian Wildlife (Protection) Act 1972. IUCN has reassessed the global status of red panda and placed it under the endangered category. Anthropogenic activities and associated global climate change are threatening the biodiversity in the Himalayas and have led to the extinction of many species of flora and fauna (Roka, 2018). Ecological disturbance is a frequent and important process in forest ecosystem mainly in the developing countries such as South East Asia (Lien, 2007). Red panda is a charismatic and a flagship species (Yonzon, 1991; Dorji, 2012) that has the ability to capture the imagination of the public and induce people to support conservation action. Red panda has been proposed as a suitable indicator species for monitoring the integrity of the broadleaf and conifer forest (William, 2006; Dorji, 2011; Panthi, 2012). In this study effort has been made to consider red panda as indicator species in the Singalila National Park, Darjeeling for the assessment of the anthropogenic stress, ecological integrity and habitat suitability for different faunal species in the area.

Study Area

The Singalila National Park is situated in the extreme North- Western boundary of Darjeeling District, West Bengal with an area of 78.6 sq km. The National Park ranges between 2400 m to 3650 m in altitude above mean sea level in the eastern part of the Great Himalayan Range, at the border of Nepal, West Bengal and Sikkim (Pradhan, 2001; Roka, 2014). Temperate zone of the park has mean temperature in summer between 7 °C to 17 °C and in winter between 1 °C to 10 °C. In sub-alpine zone, the mean summer temperature is under 7°C and in winter it is below 1°C. At 3300 m altitude and above there is regular incidence of snowfall during winter. Frost is very frequent from December to early days of March in almost 80% of the park. Mean annual rainfall is 330 cm in the park.

Methodology

The study on red panda in Singalila National Park was conducted between the years 2012 to 2016. Preliminary survey of the Singalila National Park was conducted to establish presence/ absence of the red panda in different blocks and compartment of the park. A questionnaire survey was conducted on a set performa for direct sighting and signs like faecal pellets among villagers, camp staff, guides, tourist, drivers, forest officials and researchers. For field surveys pre-existing tracks and trails within the forest at various altitudinal zones was used and red panda evidences were checked in the forest following Pradhan (2001). It was not possible to establish transects (Burnham *et al.,* 1980) due to the rugged terrain and also because of the presence of dense bamboo undergrowth in the study area. Other than direct sighting, pellet/scat gives best indication of red panda occurrence in the study habitat and was used to estimate the relative abundance of the animal in the area (Pradhan *et al.,* 2001; Roka, 2014).

There are number of proposed procedure for the selection of the indicator species (Roberts, 1985; Hutto, 1998; Kremen, 1992; Dufrene, 1997; Carignan, 2001). A simple procedure based on two quantitative criteria as proposed by Carignan (2001) was considered to select the red panda as an indicator species. Frequency of occurrence of species among area with contrasting degree of disturbance was uses as one criterion. According to the author, if a species is found more frequent in relatively less disturbed area it could be considered a positive indicator of ecological integrity (i.e. species is negatively associated with the anthropogenic distur-

bances) whereas, if a species is found more frequent in a moderately disturbed area, it could be considered as a negative indicator species of ecological integrity (i.e. species positively associated with anthropogenic disturbances). In some area selection of indicator species based on frequency of occurrence may probably influence by various natural phenomena during the time of survey. Following Hutto (1998), Carignan, 2001 suggested that using the habitat specialized species is less likely to be influenced by the natural variation in the environmental condition. Population trends were used to indicate whether the qualities of the habitat of the indicator species restricted are improving or deteriorating within the time period. These two criteria were used to consider red panda as indicator species in Singalila National Park.

Results and Discussion

Studies were conducted in Singalila National Park by various researcher and the forest officials in previous years. In year 1998, Bahuguna, Director, Darjeeling Zoo, led one study in Singalila National Park where 26 red pandas were recorded in the national park and its adjacent areas. Pradhan (2001) conducted a study where about 32 individuals were sighted in the park. In the year 2012, a census was conducted to estimate the population of the red panda in the Singalila National Park and was followed by the intensive research on the ecology, food habit and the threats of red panda in the park. During the study 27 red panda were sighted in the Singalila National Park in 2012. Presence of pellet/ scat gave good indication of presence or absence of the animal in the area and the habitat suitability for the species. Red panda pellets can be easily distinguished from that of other animals. During the study the frequency of the scat samples were very high near the water source, dense canopy forest, less disturbed area with high density bamboo and edibles fruits. Maximum scat samples were sighted on the branches, logs, rock surfaces and ground. Encounter rate of the red panda and the pellet groups/ scat samples were highest at the altitudinal level of 2900 m to 3000 m in broad leaf temperate deciduous with 56.25 %. 18.75 % scats samples were sighted in the altitude of 2400m to 2800m which was covered by the oak forest in the undisturbed area. Direct and indirect sighting was also observed in the sub alpine forest with an altitude of 3100 to 3600 m in the Singalila National Park. During the study other faunal species like wild boar, barking deer, flying squirrel, yellow throated martin, Himalayan goral, Asiatic black bear, satyr tragopan, kalij pheasant etc were recorded in the area.

Red panda prefers mature undisturbed forest for survival (Yonzon, 1991) and it was found more frequently in relatively less disturbed area in the Singalila National Park. Therefore red panda can be considered as a positive indicator of ecological integrity i.e. the species is negatively associated with anthropogenic disturbances. Red panda is a solitary and shy animal which reacts promptly to the anthropogenic disturbances and moves from the place to less disturbed area. It provides early warning of natural responses to environmental impacts and is effective over a wide range of stress (Soule, 1985; Kelly, 1990; Noss, 1990; Marshall *et al*., 1993; Munn, 1993; Woodley, 1996).

Red panda mating occurs within the month of December to March, if any disturbance occurs during the mating season the pair becomes unable to copulate resulting in the decline of the population growth. Red panda gives birth to 2 to 4 cubs during breeding season which takes place between June and September after the gestation period of 120 to 150 days. Any disturbance in the area results shifting of cubs from one place to another by female red panda and during the process cub mortality and predation occurs which ultimately result in the population decline of the species in the particular habitat. Therefore population trends of red panda can also help indicating whether the qualities of the in situ habitat of the indicator species are improving or deteriorating within the time period. Therefore, red panda can directly indicate the cause of change rather than simply the existence of change (Herricks, 1985).

While selecting indicator species sufficient baseline information like the biology, taxonomy and tolerance of a taxon's measurable characteristics of the indicator species is essential and should be understand (Hellawell, 1986; Landers, 1988; Kelly & Harwell, 1990; Regier, 1990, Pearson & Cassola, 1992; Johnson, 1993; Kremen, 1994; Hilty, 2000). Red panda being an endangered and protected animal throughout its in-situ habitat, various researches on behaviour, biology, breeding, ecology, feeding habit and threat assessment have been conducted in the different natural habitat and in captivity (Roberts, 1992; Yonzon, 1991; Wei, 1999; Choudhury, 2001;

Sharma, 2009a; Sharma, 2009b; Mallik, 2010; Dorji, 2011; Pradhan, 2001; Panthi, 2012). Red panda can be easily identified in the wild and its presence/absence can be supported by the scat/pellet in the forest. Defecation rate of the species is comparatively higher than other species and can be differentiated easily from that of other animal. Red panda being a native species of the region can function as a good indicator species, as migrant species are subject to a variety of sources of mortality on their wintering grounds and during migration (Szaro 1982; Bock 1984). Therefore, red panda can be selected as an indicator species as it is cost effective to measure and can estimated by frontline staff (even non specialist) involved in the field (Kriesel, 1984; Davis, 1989).

Conclusion

There is increasing need to find simple tool to evaluate the status of the ecosystem. During the study it was felt that it is tough to establish transect regularly due to the rugged terrain and dense bamboo undergrowth in the Singalila National Park, Darjeeling. Red panda can be used as an indicator species in Singalila National Park to assess the anthropogenic disturbance and habitat suitability for different species. Occurrence, abundance and reproductive success of the species is directly related with the anthropogenic activities. Presence of the red panda in the less disturbed area of the park gives positive indicator of ecological integrity i.e. red panda is negatively associated with the anthropogenic disturbances. Therefore, red panda as an indicator species can give information about the state of environmental quality not obtainable in other ways. Red panda can serve as an indicator species for only a narrow range of ecological conditions within the habitat type and it will not be able to represent the response of the entire ecosystem. It is not possible to measure every component of an ecosystem by using an indicator species but can be considered as an alternative for the direct measurement of the habitat as it is cost effective and quicker.

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