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THE IMPACT OF HUMAN-WILDLIFE CONFLICT IN PEECHI-VAZHANI WILDLIFE SANCTUARY, THRISSUR, KERALA

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ABSTRACT

Human-Wildlife Conflict (HWC) is a grave issue all over the world. This study was initiated to assess the overall pattern of crop damage, livestock lifting and human casualties in and around the Peechi-Vazhani Wildlife Sanctuary, Thrissur, Kerala. The period of study was from January 2012 to April 2012. The main objectives were to survey and quantify the extent of crop damage, human casualties and cattle lifting by wild animals. Three intensive study areas were selected and from each area two locations were selected covering all the human habitations with equal distance. Quadrat survey, secondary data from the Kerala Forest and Wildlife Department and questionnaire survey were the methods employed. Asian elephant (Elephas maximus), Indian wild pig (Sus scrofa), Indian crested porcupine (Hystrix indica), Sambar (Rusa unicolor), Indian giant squirrel (Ratufa indica) and Indian giant flying squirrel (Petaurista philippensis) were the wild animals involved in crop damage. The major crops damaged were coconut (Cocos nucifera), plantain (Musa paradisica) and rubber (Hevea brasiliensis). The present study revealed that Indian wild pig and Indian giant squirrel were responsible for 90 % of the crop depredation. Questionnaire survey (n=50) revealed that farmer's dependency on agriculture was 56%. Eight human attacks occurred in the past and one attack by common leopard (Panthera pardus) was reported during the study period. As a whole, economic value of crops damaged was approximately Rs. 12642/- per hectare. No cattle lifting cases were reported in the area during the period. Due to the mismanagement, the solar electric fence was not effective in mitigating crop damage. The traditional protective methods were found to be more effective. The

people residing in the enclosures and in the fringe areas should be given more awareness on biodiversity conservation, so that human-wildlife conflicts can be mitigated and better conservation of wildlife and biodiversity is achieved.

Keywords: HWC, crop raiders, cattle lifting, human casualties, protective methods.

INTRODUCTION

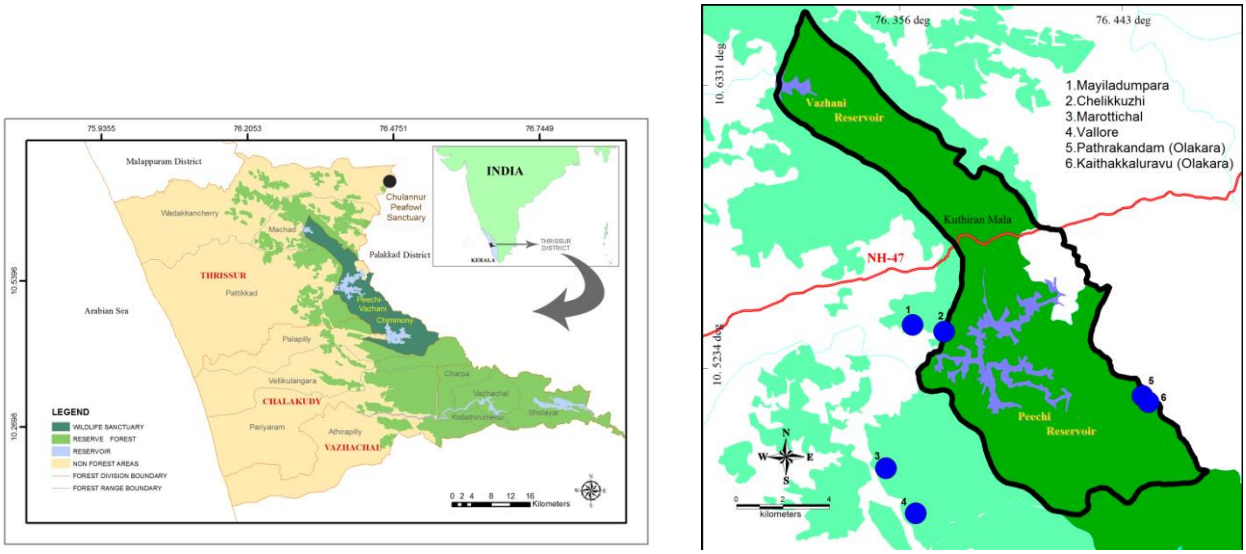
Human-wildlife Conflict (HWC) is a growing concern and is widespread in India. According to the 2003 IUCN World Park Congress, HWC occurs when human requirements overlap with wildlife requirements creating costs to both wild animals and residents (Messmer, 2010). The loss of habitat, due to land degradation through anthropogenic activities like deforestation, agriculture and urbanization leads to an ever-increasing encroachment of wildlife habitats. This is the major cause of conflict between humans and wildlife in the tropical regions (Sharma, 2011). Due to these type of activities, the natural habitat of wildlife becomes more and more fragmented and they get cramped into smaller pockets, where wildlife and humans come in contact frequently leading to conflict (Kumar, 2012). HWC is a growing problem for the communities located near the borders of protected areas. Such conflicts commonly take place as crop-depredation, livestock lifting, household damage and human casualties (Ogra, 2008). The extent of crop depredation by animals varies greatly among areas. This has direct relation with the crops cultivated, location of the cultivated land and the protection methods employed. Crop damage by vertebrate pests has been studied extensively all over the World. The vertebrate species causing damage to crop lands in and around India are Asian elephant (*Elephas maximus*), Gaur (*Bos gaurus*), Indian wild pig (*Sus scrofa*), Indian crested porcupine (*Hystrix indica*), Sambar (*Rusa unicolor*), Peafowl (*Pavo cristatus*), Indian giant flying squirrel (*Petaurista philippensis*) and Indian giant squirrel (*Ratufa indica*). While those causing human casualties and livestock lifting are tiger (*Panthera tigris*), leopard (*Panthera pardus*), wild dog (*Cuon alpines)* and Indian rock python (*Python molurus)*. Elephants forage more on cultivated crops which has more nutritive value than wild crops and the high level of crop raiding by male elephants is a consequence of its 'high-risk, high-gain' strategy (Sukumar, 1991). Species that have succeeded under the current conservation regime are the most frequent raiders and predators (Chhangani *et al*., 2008).

Crop damage by wildlife has been the new threat to agricultural productivity throughout the world (Madhusudan, 2003). Crop damage studies were carried out

extensively in Kerala (Veeramani *et al.*, 1995; Jayson., 1999) and reported that forty-five species of crops were destroyed by wild animals and of these maximum damage was made by elephants. Studies conducted in Peppara Wildlife sanctuary showed that substantial amount of crop was damaged as compared to what was consumed by wild animals (Jayson *et al*., 2008). In India, recent media reports implicate the leopard as the most common carnivore in human–carnivore conflict (Athreya *et al*., 2004). Nowadays leopards straying in villages nestling along the forest fringes in the State, attacking people and their cattle have become a matter of serious concern. This study was initiated to assess the overall pattern of crop damage, livestock lifting and human casualties in and around Peechi-Vazhani Wildlife Sanctuary and the period of study was from January 2012 to April 2012.

STUDY AREA

Peechi-Vazhani Wildlife Sanctuary (P-VWLS) lies within the geographical limits of latitudes 10^0 26'N and 10^0 40' N longitudes 76^0 15' E and 76^0 28' E in the Taluks of Thrissur and Thalappilly and in the administrative jurisdiction of Peechi Wildlife Division of Northern Wildlife Circle, Palakkad. It is the second oldest Sanctuary in Kerala with an area of 125 sq. km. The Sanctuary which forms part of the Western Ghats is a true representative unit of the gene pool of Western Ghats with all its complexity and diversity. The Sanctuary lies in the catchment of Peechi and Vazhani reservoirs. The terrain is undulating and the elevation varies from 100 m to 1000m above MSL. The vegetation ranges from evergreen patches to vast tracts of moist deciduous and semi evergreen forests. The area gets the benefit of both the south -west and north- east monsoon and the average annual rainfall is as high as 3000 mm.



(a) (b)

Fig.1 (a) Location of the P-VWLS and (b) intensive study areas in and around P-VWLS Thrissur, Kerala

Intensive study areas

Peechi-Vazhani Wildlife Sanctuary lies in the eastern part of Thrissur District. NH-47, an interstate highway- passes through the Kuthiran mala which separates the Peechi-Vazhani wildlife Sanctuary into two: Vazhani in the north and Peechi in the south. Other than NH-47 there is no other network of roads in the Sanctuary. The jam-packed traffic in the NH-47 acts as a barrier for the to- and- fro movement of animals. Three intensive study areas were selected and from each area two locations were selected for the field study. The locations were Vallore (N-10^0 27'55.9" and E-76^0 21'39.7") and Marottichal (N-10^0 29'01.3" and E-76^0 21'00.0") in the south-west (approximately 3.91 km away from the Sanctuary boundary), Chelikkuzhi (N-10^0 32'11.6" and E-76^0 22'23.8") and Mayiladumpara (N-10^0 32'19.8" and E-76^0 21'38.1") in the north-west (distributed along the sanctuary border) and Pathrakandam (N-10^0 30'35.4" and E-76^0 29'09.0") and Kaithakkaluravu (N-10^0 31'10.0" and E-76^0 26'49.7") in the north-east part of the Sanctuary (enclosures inside the Sanctuary). As the south-east part of the Sanctuary does not possess any human habitations it was exempted from field study.

METHODS

The field data was collected between January 2012 and April 2012. The whole area was surveyed on foot and vehicle for a reconnaissance survey. A total of six locations in the Sanctuary, covering all the human habitations with equal distance apart were selected for the

sampling. Three methods were employed to assess the crop damage and human-wildlife conflict in the Sanctuary. To assess the crop damage, Quadrat method was used. Six areas were surveyed for the collection of data. In each area, two control plots and six sample plots were identified and marked. As a whole, 12 control plots and 36 sample plots were visited twice in a month with a gap of 15 days. Quadrats of size 10 m x 10 m were laid for assessing the indirect evidences of wild animals. In each area two control plots were selected inside the forest, of this one plot was in the immediate vicinity of forest and another one 30 m away from the forest boundary. Indirect evidences left by the wild animals such as scats, droppings, diggings, feeding signs and scratching marks both in the control and sample plots were recorded in each visit. Similarly six sample plots of 10 m x 10 m size were selected in the fringe areas. Each plot was demarcated and marked using yellow ribbon. For each plot, details of the crop species, age of crop plant, number of damaged and undamaged plants, vegetation type, animal causing the damage, nature of damage and the cost and efficacy of the protection methods employed at the time of visit, were also recorded. Enquiries were also made with the cultivators regarding crop depredation. Coconuts damaged by Indian giant squirrel and Indian giant flying squirrel was collected and circumference of holes on coconuts were measured using vernier calipers. In order to estimate the food availability of Indian giant squirrel in the forest, PCQ technique (Cottam *et al*., 1956) was carried out in 2 locations in the fringe areas of Olakkara (Pathrakandam and Kaithakkaluravu) settlement. The efficacy of newly installed solar electric fence in the study area was evaluated by comparing the presence /absence data of animals in the control plot and plots within the electric fence. Estimation of the financial loss due to damage of crops was calculated with the help of Farm Information Bureau. A structured questionnaire survey (n=50) was also conducted among the villagers of the selected settlements for collecting information on crop damage and conservation attitudes. Single interviews were conducted primarily with the head of the household. Interviews were made at their home and roughly 15 to 20 minutes was taken for a respondent. One human injury was occurred during the study period and the place where encounter happened was visited and habitat parameters recorded and the victim was also interviewed in the hospital. Past incidences of crop raids reported to the Forest and Wildlife Department and the details of the compensation claimed for the past 3 years was collected and analyzed.

RESULTS

1. Crop damage

Indian wild pig (*Sus scrofa*), Indian crested porcupine (*Hystrix indica*), Indian giant squirrel (*Ratufa indica*), Indian giant flying squirrel (*Petaurista philippensis*), Sambar (*Rusa unicolor*) and Asian elephant (*Elephas maximus*) are the animals involved in crop damage in the P-VWLS. Indian wild pig caused damage to coconuts, rubber and plantains. The mode of damage on fallen coconuts was by removing the fibers, cutting the coconut shell and finally eating the endocarp of the nuts. The damage to plantains was by uprooting the plantain and feeding the basal portions. Rubber plants with < 5 years of age were damaged by stripping the bark using the tush. Damage by Indian wild pig was severe in Marottichal (38%) Chelikkuzhi (37%) and Kaithakkaluravu (19%) areas. Indian crested porcupine damaged coconuts which were fallen on the ground and debarked the basal portion of coconut trees. The major difference between the coconuts damaged by Indian wild pig and Indian crested porcupine was in the tearing pattern of coconut fibres. When the nut attacked by Indian crested porcupine the fibres will have a smooth and sharp ends and if it is by a Indian wild pig, the edges will be irregular in shape (Plate 1 a). Damage by Indian crested porcupine was recorded from Marottichal, Chelikkuzhi, Pathrakandam and Kaithakkaluravu. Sambar caused extensive damage to rubber trees which are less than 5 years by browsing on young leaves and stripping the bark by its antlers (Plate 1b). Sambar also damaged plantains of less than 2 weeks and the damage was severe in Kaithakkaluravu (Plate 1c).

(a) (b) (c)

Plate 1. (a) Mode of damage on coconut by wild pig and Indian crested porcupine
(b) Browsing of rubber leaves and (c) by feeding on plantain by sambar

Indian giant squirrel an endemic species in the Western Ghats fed on tender coconuts and caused huge economic loss to the farmers (Govind *et a*l., 2010). As it is a diurnal crop raider, the feeding behaviour was observed in the field. Feeding on coconuts starts from early morning to 8

am and after 4 pm up to the sunset. Drey of Indian giant squirrel was recorded near the coconut plantations where damage by the squirrel was recorded. Water content was the main reason for feeding on tender coconuts. They first removed the exocarp, then mesocarp and finally fed on the endocarp (Plate 2a, b).

(a) (b) (c)

Plate 2. (a) and (b) Tender coconuts damaged by Indian giant squirrel
(c) Tender coconut damaged by Indian giant flying squirrel

The holes were small, medium or large in size (19±4 cm) and were in the lateral portion (Plate 2c). The edges of the holes were in irregular shape. People consider Indian giant squirrel as a habitual coconut feeder. Not only coconuts, other fruits like jackfruit were also raided by them. The feeding of Indian giant squirrel on coconuts was severe in Kaithakkaluravu, Pathrakandam and Chelikkuzhi. Indian giant flying squirrel was another coconut raider and was nocturnal in habit. Similar to Indian giant squirrel, they also fed on tender coconuts. The only difference was that the holes made by them was small, compared to that of Indian giant squirrel and the position of hole will be at the apex. Feeding of Indian giant flying squirrel on coconuts was recorded only at Marottichal. Chelikkuzhi in the immediate border and Pathrakandam and Kaithakkaluravu, the enclosures have higher damage on coconuts by Indian giant squirrel. An increase in the number of coconuts damaged was seen in the Pathrakandam area, during January and February months. Later a sharp decline was recorded as a result of the implementation of safety measures. The safety measure adopted by farmers in the Pathrakandam area was to cut down the arecanut palms growing in between the coconut trees. As it is an arboreal and moves from one coconut palm to other coconut palm by crossing through arecanut palms. When the arecanut palms were removed, connection between the coconut palms was lost and could not reach to coconut palms. This was found to be the reason for the decline in crop damage.

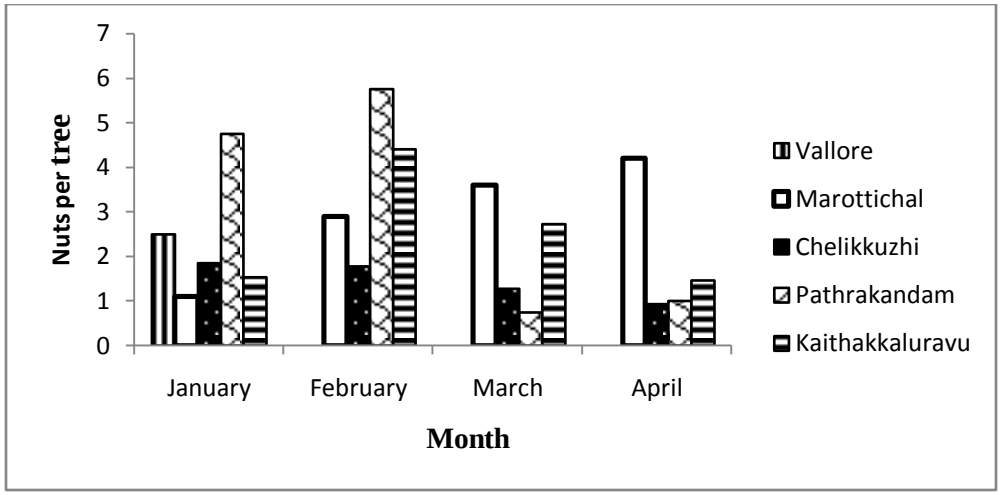


Fig.2. Coconuts damaged by Indian wild pig, Indian crested porcupine, Indian giant squirrel and Indian giant flying squirrel in the Peechi-Vazhani Wildlife Sanctuary, Thrissur Kerala

Coconut damage was higher at Kaithakkaluravu during the month of February and later this was found to be decreasing. A decreasing trend of coconut damage was also seen in Chelikkuzhi. The mean circumference of holes made by Indian giant squirrel was 19 cm (±4) (n=209) and that of Indian giant flying squirrel was 9 cm (±2) (n=43). In comparison, the damage caused by Indian giant squirrel was more compared to Indian giant flying squirrel. According to Ramachandran (1988) *Xylia xylocarpa, Bombax ceiba, Ficus bengalensis, Grewia tilinifolia* and *Lagerstroemia microcarpa* are the species preferred by Indian giant squirrel for feeding. These species are available in the study area also. From this presumably we can say that, there is no shortage of food inside the forest for Indian giant squirrel. Legal protection and human attitudes increased the frequency of entry of Indian giant squirrel into the farm lands.

Control measures:

The efficacy of newly installed solar electric fence was found to be very less. Improper maintenance was recorded as the major problem for the failure of electric fence. The problem is aggravated because the solar electric fences were installed after replacing the traditional fences. But now, both solar electric fence and traditional fences are not working and the people are facing severe crop damage.

Estimation of economic loss:

The mean weight of partially dehusked coconuts was 300 ± 228 gm. Month wise price of coconuts was collected from Farm Information Bureau and that amount was multiplied with the

number of coconuts lost as a result of wildlife damage. As a whole, economic loss of damaged crops is Rs. 4551/- in an area of 0.36 hectare and it is approximately Rs 12642/- per hectare. No cattle lifting cases were reported in the area during the period of study.

2. Human Casualties

A man was attacked by a leopard at Kaithakkaluravu enclosure in Olakkara area of the Sanctuary on sunday 19th February 2012 at 8.30 pm. The incident happened, when four people were on their way to take bath in a rivulet inside the forest, which was about 100 m away from the victim's house. Of the four people, 3 of them were walking in the front and the victim was walking alone behind. Leopard suddenly pounced on the victim and the victim sustained major injuries in the attack. He was bitten on the leg and the leopard crushed his left hand. In the struggle another person was also bitten by the leopard. As the Kaithakkaluravu enclosure is an encroached village inside the P-VWLS, the area had a past history of many cases of cattle and dog lifting. Due to these problems, the people in the locality stopped rearing of cattle in large numbers and the remaining cattle are protected in closed stables. Residents reported that a leopard attacked a dog in the courtyard of victim before a month. Even though, for the past 6-7 years, animal lifting cases were reported, this is the first incident, where a leopard attacked a human. Dogs were not with them when the incident happened. Whether the attack was defensive or predatory was yet to be cleared.

Ex-gratia to HWC

Ex-gratia paid during the past 3 years were collected from the Peechi and Pattikkad Forest Ranges and of that 81 % ex-gratia were claimed by the people in Pattikkad Forest Range. While only 19 % were claimed in the Peechi Forest Range. Ex-gratia claimed was classified into three categories namely crop damage, livestock lifting and human casualties respectively. Ex-gratia for crop damage was given to the people with the advice of agricultural officers. Similarly ex-gratia for cattle lifting was determined by veterinary doctors who did the post mortem. Human casualties include death as well as injuries. The maximum amount given for a human death is Rs. 1 lakh and for the injury it is determined by the doctor who treats the victim. A sharp decline in the number of livestock lifting cases is recorded over the years. From the ex-gratia requests, it was clear that Asian elephant and Indian wild pig were the most common animals which raided crops. In case of livestock lifting, wild dog and leopard plays an important role. Human casualties were happened due to snake bite, Indian wild pig, bonnet macaque, sloth bear and

leopard. Total amount sanctioned by Pattikkad and Peechi Forest Ranges within 3 years for crop damage was Rs. 86430, for livestock lifting Rs. 101470 and for human casualties is Rs. 907633.

Questionnaire Survey

Questionnaire survey (n=50) revealed that agriculture was the, main occupation of the people. Coconuts, plantain, rubber, arecanut, tubers, vegetables, nutmeg and pepper were the main crops cultivated by the respondents. Both good and moderate qualities of crops have been damaged. Asian elephant, Indian wild pig, Indian crested porcupine, Sambar, Indian giant squirrel, Indian giant flying squirrel, Peafowl and monkeys were the major animals involved in crop raiding. Indian giant squirrel, Indian giant flying squirrel and Indian wild pig are the habitual crop depredators. Bush fence, barbed fence, net, crackers, fire, stonewalls, plastic sheets, tin and dogs were the protective measures used by the respondents. A total of 36 goats, 2 cattle and 6 dogs were lifted from the respondents' house within last 5 years leopard (52%), wild dog (44%) and python (14%) are the animals involved in livestock lifting.

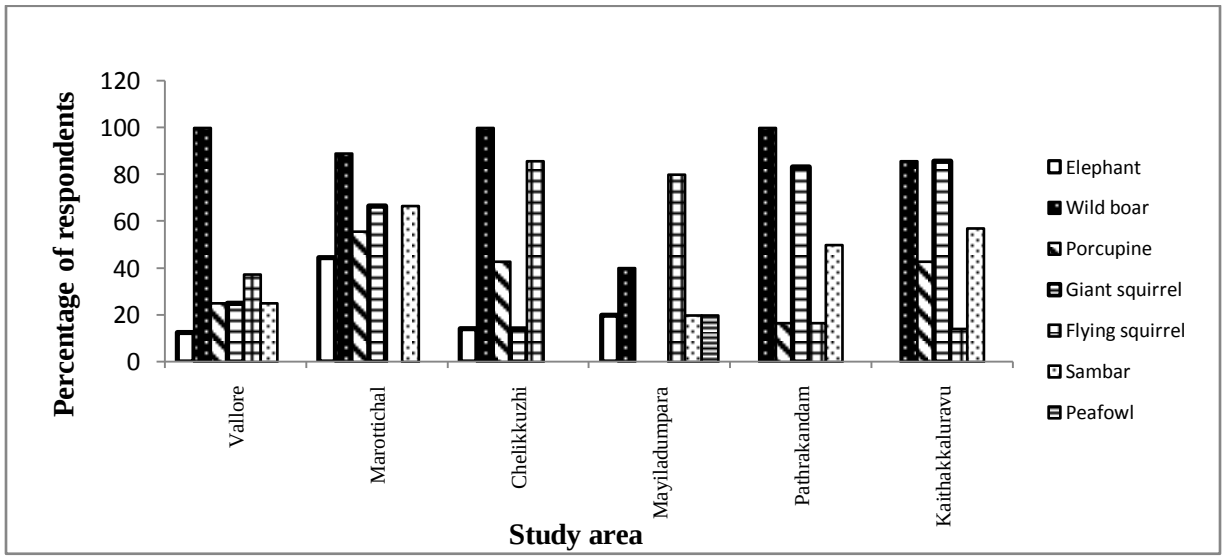


Fig.35 Species involved in crop raiding in selected study areas

DISCUSSION AND CONCLUSIONS

Indian wild pig and Indian giant squirrel were involved in 90 % of crop raiding and coconut was the most affected crop. A number of factors influence the crop raiding behaviour of wild animals. Ineffective protective measures, increase in the animal population, cultivating crops up to the forest boundary and nutritive value of crops compared to the wild species are some of the reasons for crop damage. The crop raiding incidents were higher in the settlements of

Pathrakandam and Kaithakkaluravu enclosures in the Sanctuary. Planting of plantains as an inter crop in rubber plantations in the forest fringes increase the damage by Asian elephant and Indian wild pig. Coconuts are damaged by wild pig, Indian giant squirrel, Indian crested porcupine and Indian giant flying squirrel. Of these, more damage is caused by Indian giant squirrel. Severe damage to coconuts is seen in the coconut palms adjacent to the Sanctuary. Compared to Indian giant squirrel, Indian wild pig causes great threat to both crop and human safety. Indian wild pig damaged a variety of crops like coconut, plantain, rubber, vegetables, tubers and jackfruits. Of these, damage on coconut, plantain and rubber was recorded from the study area. Sambar damage rubber plants of less than 5 years by feeding on young leaves and stripping the bark of the stem. Indian crested porcupine damaged coconuts and debarking signs were recorded in coconut palms. Indian giant flying squirrel attack on coconuts was recorded only from Marottichal, while Indian giant squirrel feeding on coconuts was seen in Pathrakandam, Kaithakkaluravu and Chelikkuzhi. From the field data and questionnaire survey it was evident that the crop damage is linked with the distance from the forest. Severe crop damage is seen in Pathrakandam and Kaithakkaluravu enclosures, less damage is seen in Chelikkuzhi and Marottichal and moderate in Mayiladumpara and Vallore. Indian giant squirrel is an endemic species and Asian elephant is an endangered species. Due to the strict implementation of wildlife laws, farmers are afraid of causing casualty to animals. Solar electric fence is employed by the Kerala Forest and Wildlife Department for the protection of people living in the enclosures but this is an absolute failure. Solar electric fence was installed in January 2012 and for about a week only, it was successful. Improper maintenance of fence is leading to its ineffectiveness.

Cattle lifting is another serious problem faced by the farmers. Straying of wild dog and leopard to villages are common. The main reason for this is the grazing of cattle inside and along the fringes of forest. Compared to the past a decreasing trend of cattle lifting is recorded. Dependency on cattle rearing reduced and as a result, cattle numbers are also declined. Moreover the remaining cattle are kept and maintained in closed cages. Leopard attacked a man in the Kaithakkaluravu enclosure. Usually leopards prefer dogs for food, but during the incident it was reported that no dogs were with them. The circumstances indicate that, it was a purposeful attack on the man. This must be treated as a serious management issue of the Peechi-Vazhani Wildlife Sanctuary. The present study revealed that Indian wild pig and Indian giant squirrel were responsible for most of the crop depredation in the Peechi-Vazhani Wildlife Sanctuary. Even

though elephant visit was recorded in the control plot, no damage occurred in sample plots. Of the damaged crops, highest economic loss was for coconuts, then plantains and rubber. During the study period no cattle lifting cases were reported.

Questionnaire survey revealed that farmer's dependency on agriculture was 56%. Fifty four per cent were supportive to conservation and they believe the need of wild animals in the forests. Eight human casualty incidences occurred in the past, including 6 injuries and 2 human deaths. Both the human deaths were happened in 2011 and this is a serious face of human-wildlife conflict and the human death should be considered as a serious issue. One human attack by leopard was reported during my study period from Kaithakkaluravu enclosure. This also should be considered as a serious issue, because this is the first incidence recorded from the sanctuary. The solar electric fence is not effective in mitigating crop damage in the sanctuary and this was mainly due to the mismanagement of the fence. The traditional methods adopted for crop protection were ordinary fence, bush fence, barbed fence, net, plastic sheets, tin, crackers and guarding by dogs. Guarding by dogs and crackers was found to be effective against wild pig, Indian crested porcupine and sambar to a certain extent. The people residing in the enclosures and in the fringe areas should be given more awareness on biodiversity conservation, so that human-wildlife conflicts can be mitigated and better conservation of wildlife and biodiversity is achieved.

RECOMMENDATIONS

1. The enclosed villages in the Pathrakandam and Kaithakkaluravu are hindrance to the free movement of wildlife. Measures may be taken for shifting these villages to outside the Sanctuary, thereby consolidating area and ensuring free movement of wildlife.
2. Solar electric fencing was found to be the most effective control measure in Pathrakandam and Kaithakkaluravu settlements, if properly maintained.
3. Plantains are more prone to Asian elephants. So planting them as an inter crop in the fringe areas should be stopped.
4. Practicing agriculture up to the forest fringe will lead to wildlife damage, so this practice must be terminated.

5. Branches of trees, touching the coconut palms should be removed, so that damage by Indian giant squirrel can be decreased.
6. Live stock within the forest areas should be reduced.
7. Grazing of cattle in the forest fringes and inside the forest must be stopped in order to reduce cattle lifting.
8. Eco-development programmes may be taken up as an alternate source of livelihood for the people depending on the forest which would reduce their impact on wildlife habitat.
9. Ex-gratia for damage due to wildlife is not a permanent solution to the problem. However timely action for compensating the loss due to crop raiding would help in building up a good rapport with people.

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