Monitoring and conservation of small wild cats in Human mediated landscapes in Hill Country Sri Lanka

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Project 25393-1

Introduction

Sri Lanka is an island located in the Indian Ocean with an area of 65,610 km^2. Sri Lanka has a very rich diversity of flora and fauna and is the country that claims the highest species density for flowering plants, amphibians, reptiles, and mammals in the Asian region (NARESA, 1991). Despite its small size, Sri Lanka is an island that boasts a great ecosystem and species diversity (Wijesinghe et al, 1993). Among the 91 species of native mammals found on the island 14 species are of the order Carnivora (Miththapala S.,2006) including The Sri Lankan leopard (*Panthera pardus kotiya*), an endangered, endemic sub-species, which is the island's apex predator(Kittle et al,2017)

Currently, our planet is facing a great environmental change. Around the globe, many ecosystems are facing consequences of rapid change in the environment subjected to the negative effects of human population growth and ecological footprint (Jackson *et al*. 2001). There are 21.44 million people live in Sri Lanka, and human densities exceed 300 people/km^2 with almost 80% of the population living in rural areas. Even though many of the mammals show a wide distribution within Sri Lanka, a majority of the endemic and threatened mammals are confined to the montane, sub-montane, and lowland rain forests of the wet zone and intermediate zone. Where habitat loss and degradation are taking place at a rapid rate. Furthermore, Human activities increase in natural areas is leading to an increase in threats of wildlife and unexpected impact on wildlife diversity, distribution and activity patterns (Oberosler et al., 2017). Small carnivores, such as the fishing cat and brown mongooses, live in small urban forests and marshes which are at risk of being converted to human use, endangering these small urban populations. Hunting and killing to avoid conflict also remain a major concern, especially for the large charismatic species (Weerakoon D.K & Goonatilake S.,2006).

Carnivores/especially wild cats tend to occur at low densities and in small populations, which makes them particularly vulnerable to habitat loss, poaching, and local extinction (Woodruffe and Ginsberg 1998, Cardillo et al. 2004). More studies about charismatic carnivores like Leopards, sloth bears have been done targeting the major protected areas like Yala, Wilpattu, Horton plains in Sri Lanka. But little empirical data exist on past or recent distributions, threats, human-carnivore conflict, and behaviors in different landscapes about these animals. (Santiapillai and Santiapillai 1990)Table 1.

Tabel1. Carnivore species of Sri Lanka (Phillips 1984), International Union for Conservation of Nature/Species Survival Commission (IUCN, S.S.C., 2001.) Red List 2019 status update

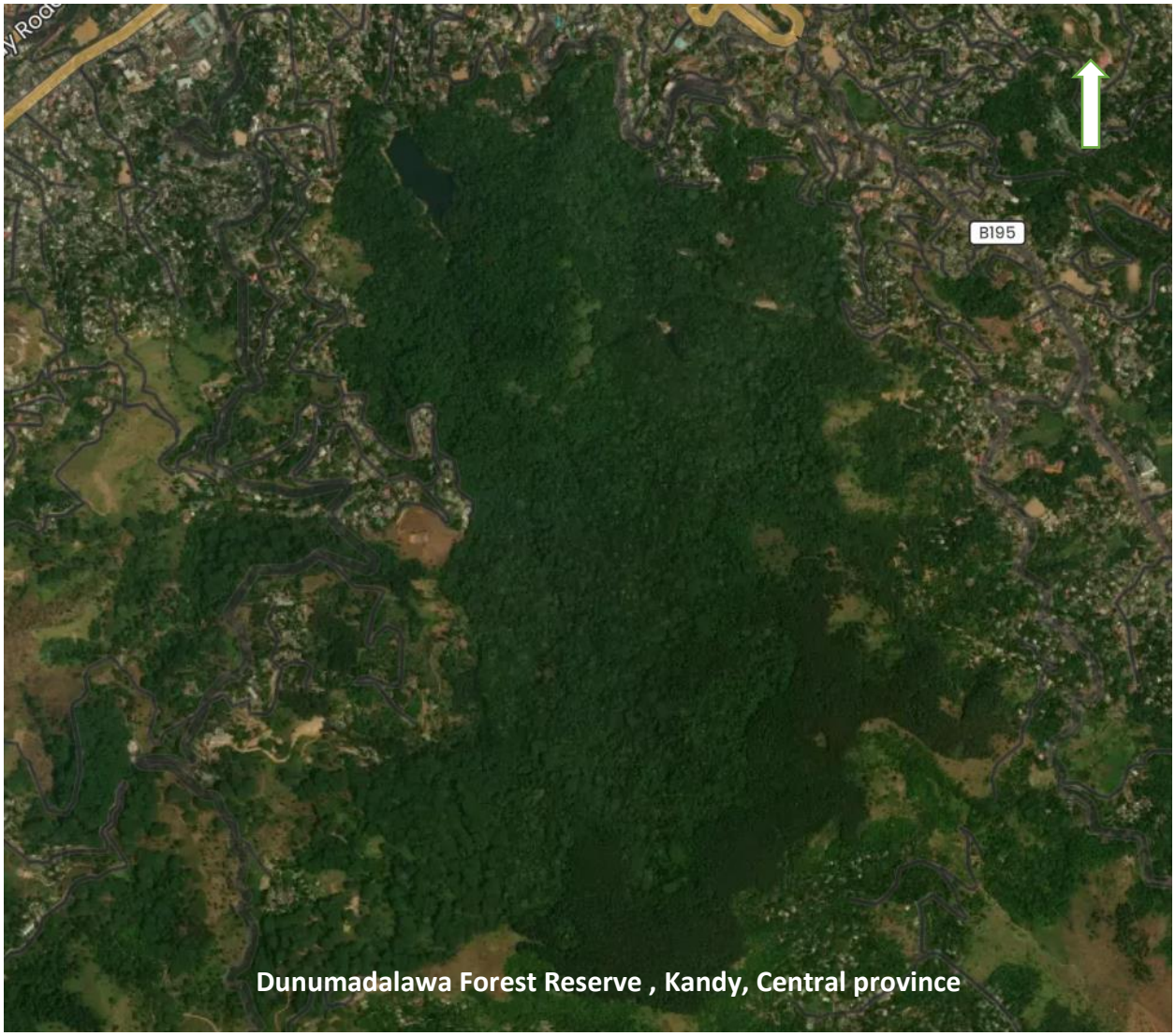
Family	Common name	Scientific name	IUCN status/2019
Felidae	Jungle cat	*Felis chaus*	Least Concern
	Fishing cat	*Prionailurus viverrinus*	Vulnerable
	Rusty spotted cat	*Prionailurus rubiginosus*	Near Threatened
	Leopard	*Panthera pardus*	Vulnerable
Canidae	Golden jackal	*Canis aureus*	Least Concern
Ursidae	Sloth bear	*Melursus ursinus*	Vulnerable
Mustelidae	European otter	*Lutra lutra*	Near Threatened
Viverridae	Small Indian civet	*Viverricula indica*	Least Concern
	Common palm civet	*Paradoxurus hermaphroditus*	Least Concern
	Golden palm civet	*Paradoxurus zeylonensis*	Least Concern
Herpestidae	Indian grey mongoose	*Herpestes edwardsi*	Least Concern
	Indian brown mongoose	*Herpestes fuscus*	Least Concern
	Indian ruddy mongoose	*Herpestes smithii*	Least Concern
	Stripe-necked mongoose	*Herpestes vitticollis*	Least Concern

Through Small Cat Advocacy and Research organization (SCAR), by the funding support of various organizations, we have initiated many works arounds Sri Lanka which include monitoring of fishing cats in some wetlands in Colombo, forest patches in Kandy, and Polonnaruwa. In addition to that, we also have collaborated with the Department of wildlife conservation/ other government organizations to donate much-needed vaccines, road signs implementations, rehabilitation enclosures for wild cats in different regions in Sri Lanka. But there are still much more work and gaps towards the conservation of carnivores in the country.

Through this study, we were aiming to conduct the monitoring through camera trapping, personal interviews with villagers and interviews with the park management officers in Dunumadalawa Forest reserve , Kandy to gain knowledge about the current population trends about carnivores prioritizing the wild cats and the threats they face in nearby habitats. Afterward, we will be working on specific threat mitigation methods in particular study site and its surrounding area to mitigate them along with the continuous monitoring of the impacts of our practices.

Materials & Methods

Study Site :



project site - Dunumadalawa forest reserve kandy

Dunumadalawa Forest Reserve (7o17'00"N; 80o 38'49"E, 548-972 m above sea level; also known as Walker Estate or 'Waraka Wattha'), is a semi isolated, mid-country wet zone forest fragment situated in the Kandy District. It is approximately 480 ha in extent and is located within the municipal limits of the Kandy City. Dunumadalawa comprises mainly of secondary growth forest since the site has been used earlier for tea and cocoa plantations. At present, few primary forestpatches are remaining in the forest reserve. This historical forest reserve forms the catchment and protects the watershed of two reservoirs known as Dunumadala Wewa and Roseneath Wewa

which augment the water supply to the Kandy City (Dharmasena et al., 2001)

Methods

- **Pilot surveys**

Select the study areas according to the sightings, proximity to human settlements, and historical records of threats

A pilot survey in habitats and nearby human settlements

- **Camera tarp study**

Twenty cameras will be used in the study in order to monitor the carnivore diversity and interactions. They will be mounted using the straps and steel rod against tree stems. Cables and two padlocks will use in each trap to protect them from poachers and wild animals. Each camera station will separate approximately 250 to 1000m distance to minimize the double capturing in the cameras (Li et al., 2018; Dillon & Kelly, 2007). Cameras will set up at ankle height (0.25m to 0.75m) considering the targeting animal's height (Trolle & Kery, 2003). Camera traps will have equipped with 8 rechargeable batteries and a 16 Gb memory card to store the pictures. The date and time will be fixed by going through settings in the cameras after replacing the new batteries. After that capturing mode will switch to Photo mode and the resolution will be selected as 12 Mega Pixel or to the maximum that the camera trap band provides. Additionally, standard two short modes and sensitivity of the camera will be arranged.

Identification will be done via obtained photographs from camera trapping, using the markings patterns of the carnivores and individual identification will be done for further understanding. This method was successfully used to identify pumas in South America (Kelly *et al*., 2008).

- **Data Analysis Method**

After camera trap data sorting R software will be used alongside with "camtrapR" package to manage the data. The "camtrapR" package, version 0.99.1, is written in the R language and was first released on CRAN in July 2015. It can be used under R version 3.1 (R Core Team 2015). Through that camera trap, data will proceed through a sequence such as (Niedballa J. et al,2016).

1. *Image organization and management*: Setting up a directory structure for storing raw camera trap images and optionally renaming
2. *Species/individual identification*: Species and individual identification by metadata tagging and checking species lists with taxonomic databases, verifying identification
3. *Image data extraction*: Tabulation of species records and extraction of image metadata
4. *Data exploration*: Visualization of spatial species occurrence patterns
5. *Data export*: Preparation of input files for subsequent analyses in occupancy

- **Awareness-raising materials and school programs**

Provide materials like posters and booklets about the target animals and organize resource personals to give talks and interactive lessons about target animals and their habitats. Organize competitions and arrange gifts for winners.

Awareness materials will be produced through the guidance of the principal investigators and Co-investigators who are specialized in science education. We will produce multiple documents with different difficulties to address different levels of society and schools. All the materials will be produced in three main languages used in the country. The artwork and infographics will be design through local artists through the direct observations of the project team members.

- **Youth camp program**

Youth camp is a program dedicated to university students who study zoology /ecology and botany as a major. They will go through two-day camping programs with resource personals who teach them practical lessons of monitoring and handling etc.

Work conducted so far

Field work for camera trapping

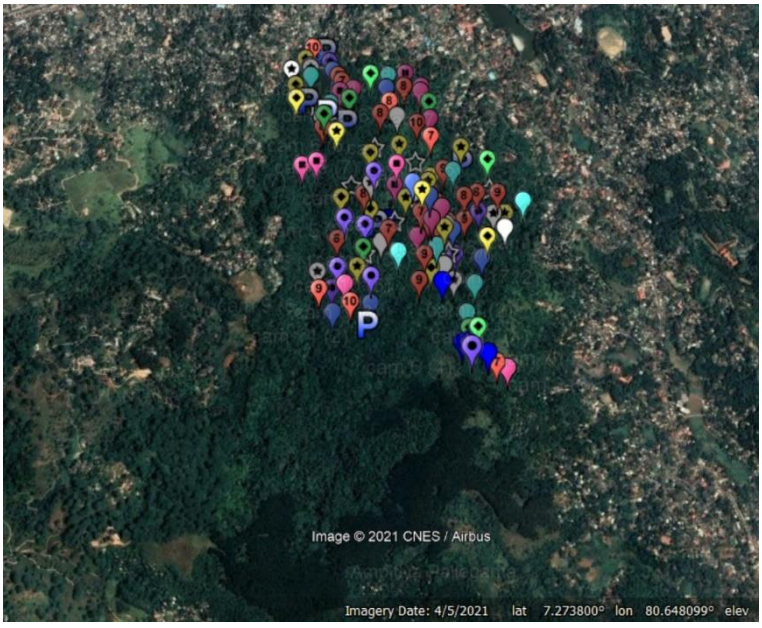


Figure1. Camera trapping pin point locations in Dunumadalawa Forest reserve (more than 45% of reserve area have been surveyed)

So far we have completed 45% of the Dunumadalawa forest area with camera traping in past time period and we have collected 187870 records including photos and videos through out the project.

We have placed 20 camera traps with with the distance of 100 to 200m from 2019 January to 2021 and monitored the cameras after 30 to 45 days of time period. Cameras were placed as mentioned in methode but in places with high human precensce they were placed in top of trees targerting the path or trial.

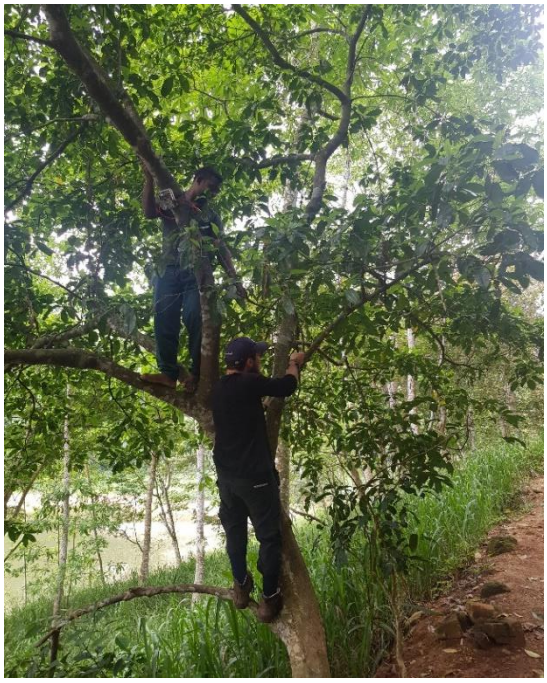
Through camera trapping we have recorded many important species and some of the species were recorded for the 1st time through this project (Eg: sambar deer)

Recorded species list

Scientific name	Common name
Family : Felidae	
Panthera pardus	Sri lankan Leopard
Prionailurus rubiginosus	Rusty-spotted cat

Prionailurus viverrinus	Fishing cat
Family : Herpestidae	
Herpestes brachyurus	Brown mongoose
Herpestes edwardsii	Grey mongoose
Herpestes smithii	Ruddy mongoose
Herpestes vitticollis	Stripe-necked
Family : Viverridae	
Paradoxurus hermaphoditus	Palm Civet
Viverricula indica	Ring tailed civet
Paradoxurus aureus	Golden palm Civet
Family : Cervidae	
Rusa unicolor	Sambur
Muntiacus muntjak	Barking deer
Family : Suidae	
Sus scrofa	wild boar
Family : Tragulidae	
Moschiola meminna	Sri Lankan mouse deer
Family : Hystricidae	
Hystrix indica	Porcupine
Family : Sciuridae	
Funambulus palmarum	Palm squirrel
Funambulus obscurus	Dusky striped jungle squirrel
Family : Leporidae	
Lepus nigricollis	Black napped hare
Family : Cercopithecidae	
Macaca sinica	Sri Lanka toque monkey

Setting up camera traps



Setting Up and checking camera traps in Dunumadalawa Forest Reserve

Species photos

Sri Lankan Leopard

Fishing cat

Rusty spotted cat

Sambur deer

Barking deer

Sri Lankan mouse deer

Porcupine

Wild boar

Stripe-necked Mongoose

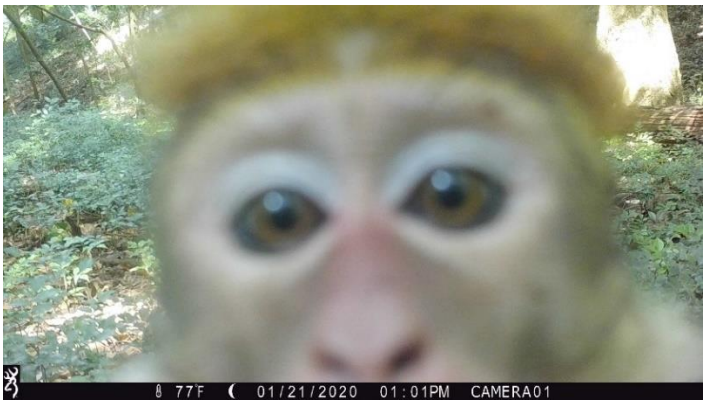
Brown Mongoose

Ring tailed civet

Ruddy Mongoose

Indian civet

Golden palm civet



Sri Lanka toque monkey

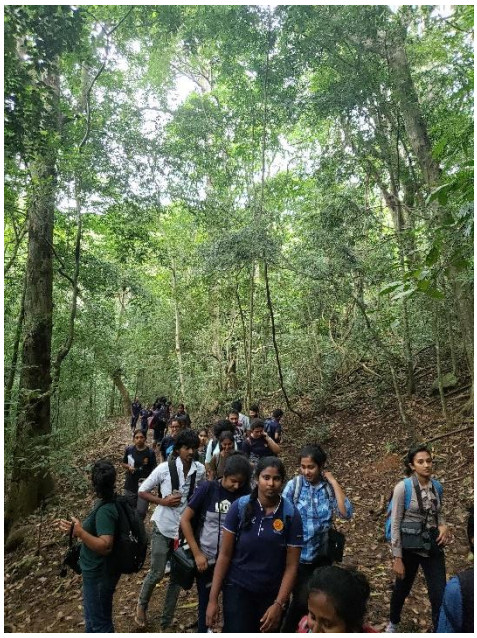
Black napped hare

Youth camp program

Awareness raising materials and Youth camp 2018 were organized for collaborating with the University of Peradeniya , Department of zoology Students to educate about the wildlife monitoring and conservation.

Two day Youth camp event for university students in 2018

Additionally , We have conducted a awareness rising youth camp program for 35 students in University of Peradeniya in 2019 by inviting them to the study site. They were thought about camera trapping, mammal monitoring, radio telemetry and other related wildlife monitoring methods. Addition to that we have given chance to explore different habitats in the study site by organizing an nature work along with the assistance of the park management team



During 2019 program for university students - Nature walk after lecture series

Awareness program

We have given public talk targeting school kids incorporating findings of this study site in 2019. This program was organized by the wildlife sociality in t Silvester's college Kandy.

Awareness raising program for school kids (12 schools) in central province Sri Lanka (File covers and leaflets were also used in education)

Other Conservation related activities

- Building small size mammal handling cage for Dunumadlawa park management
- Conduct Introductory presentation about the project work and the activities of the project to the park management team

Future Activities

- Complete the public interview (postponed due to covid)
- Conduct the camera trapping in rest of the reserve area Phase 2 of the project
- Publish detail report
- Organize awareness programs and youth camps
- Place information bords to educate the public about the forest, its protection and species
- One day workshop for the park management team including veterinary and animal handling training

References

Jackson, R.B., Carpenter, S.R., Dahm, C.N., McKnight, D.M., Naiman, R.J., Postel, S.L. and Running, S.W. (2001). Water in a changing world. *Ecological applications*, *11*(4), pp.1027-1045.

Kittle, A.M., Watson, A.C., Cushman, S.A. and Macdonald, D.W. (2018). Forest cover and level of protection influence the island-wide distribution of an apex carnivore and umbrella species, the Sri Lankan leopard (Panthera pardus kotiya). *Biodiversity and conservation*, *27*(1), pp.235-263

Li, X., Bleisch, W. V., & Jiang, X. (2018). Using large spatial scale camera trap data and hierarchical occupancy models to evaluate species richness and occupancy of rare and elusive wildlife communities in southwest China. *Diversity and Distributions*, *24*(11), 1560–1572. https://doi.org/10.1111/ddi.12792

Miththapala, S. (2006). The ecology of the wild cats of Sri Lanka. *The Fauna of Sri Lanka: Status of Taxonomy, Research and Conservation. The World Conservation Union (IUCN) Colombo Sri Lanka*, pp.235-254.

Niedballa, J., Sollmann, R., Courtiol, A. and Wilting, A. (2016). camtrapR: an R package for efficient camera trap data management. *Methods in Ecology and Evolution*, *7*(12), pp.1457-1462.

Oberosler, V., Groff, C., Iemma, A., Pedrini, P. and Rovero, F. (2017). The influence of human disturbance on occupancy and activity patterns of mammals in the Italian Alps from systematic camera trapping. *Mammalian Biology*, *87*(1), pp.50-61.

Phillips, W.W.A. (1980). *Manual of the mammals of Sri Lanka* (Vol. 1). Wildlife and Nature Protection Society of Sri Lanka.

Santiapillai, A. and Santiapillai, C., (1990). Status, distribution and conservation of the sloth bear (Melurus ursinus) in Sri Lanka. *Tigerpaper (FAO)*.

Trolle, M. & Kery, M. (2003). Estimation of ocelot density in ´ the Pantanal using capture–recapture analysis of cameratrapping data. J. Mammal. 84, 607–614.

Weerakoon, D.K. and Goonatilake, W.D.A. (2006). Taxonomic status of the mammals of Sri Lanka. *Fauna of Sri Lanka: Status of Taxonomy, Research and Conservation, IUCN Sri Lanka, Colombo, xiii+ 308pp*, pp.216-231.

Wijesinghe, L.D.S., Gunatilleke, I.A.U.N., Jayawardene, S.D.J., Kotagama, S.W. and Gunatilleke, C.V.S. (1993). Biological conservation in Sri Lanka: A national status report. *IUCN, Sri Lanka, 100pp*.

Woodroffe, R. and Ginsberg, J.R. (1998). Edge effects and the extinction of populations inside protected areas. *Science, 280*(5372), pp.2126-2128.