

Use of raised plastic water-pipes by Common Palm Civet *Paradoxurus hermaphroditus* for habitat connectivity in an anthropogenic environment in West Java, Indonesia

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Abstract

Common Palm Civet *Paradoxurus hermaphroditus* is a small nocturnal carnivore ranging across South and Southeast Asia that adapts well to human habitats. A single camera-trap recorded several instances of Common Palm Civets crossing a water-pipe in an agroforest in West Java, Indonesia. Water-pipes might be used because of low arboreal habitat connectivity there. Such use is further evidence of the species's high tolerance to human activity. Its widespread overlap with people must place it on the front line for the civet-trade demand, yet there is no information of whether this is having any effect on the wild population. An island-wide population survey to help understand changes in wild populations is warranted as a result of recently increased trade in the species.

Keywords: agroforest, camera-trap, conservation, fragmentation, movements, synanthropy

Pemanfaatan pipa air plastik tergantung oleh musang luwak *Paradoxurus hermaphroditus* sebagai penghubung antar habitat pada wilayah hunian manusia di Jawa Barat-Indonesia

Abstrak

Musang luwak *Paradoxurus hermaphroditus* merupakan karnivora kecil nokturnal yang tersebar dari wilayah selatan hingga tenggara benua Asia, yang telah mampu beradaptasi dengan baik terhadap lingkungan kehidupan manusia. Sebuah perangkat kamera merekam beberapa kejadian dari musang luwak yang menyebrangi pipa air tergantung menuju wilayah seberang di Jawa Barat, Indonesia. Digunakannya lintasan ini dikarenakan rendahnya jalur penghubung yang ada. Penggunaan jalur ini menunjukkan tingginya tingkat adaptasi satwa terhadap kehidupan di lingkungan manusia. Ketersinggungan kehidupan satwa ini dengan manusia perlu memperhatikan akan kebutuhan hidupnya, dan belum ada keterangan bagaimana pengaruhnya terhadap populasi di alam. Survey terhadap populasi yang terpecah akan membantu dalam memahami perubahan populasi di alam dan merupakan jaminan keberlanjutan kehidupannya sebagai akibat dari meningkatnya perdagangan jenis satwa ini.

Introduction

Civets (Viverridae) are small nocturnal carnivores found in Asia and Africa. Common Palm Civet *Paradoxurus hermaphroditus* ranges across South and Southeast Asia to southern China and is found on many islands of the Greater Sundas, including the Indonesian island of Java (Jennings & Veron 2009). Reflecting its wide distribution, large population size and adaptability to altered habitats, it is listed as Least Concern on *The IUCN Red List of Threatened Species* (IUCN 2013). Common Palm Civet occurs in a wide range of habitats up to 2,400 m altitude (Heaney *et al.* 1998). These include primary and secondary evergreen and deciduous forests, plantations, logged forest and human settlements (e.g. Stuebing & Gasis 1989, Duckworth 1997, Krishnakumar & Balakrishnan 2003, Meijaard *et al.* 2005, Chua *et al.* 2012). It is highly frugivorous and an important seed disperser (Nakashima & Sukor 2010), but it also consumes small vertebrates and invertebrates. It is solitary and largely arboreal, sleeping during the day in trees or in dwellings such as houses and farm sheds (Rabinowitz 1991, Jennings & Veron 2009).

Despite its wide distribution, knowledge of Common Palm Civet behavioural ecology is still limited. Radio-tracking in Thailand and Nepal indicates that forest-dwelling Com-

mon Palm Civets are relatively reliant on arboreal pathways (Rabinowitz 1991, Joshi *et al.* 1995, Jennings & Veron 2009). Even less is known about how they survive in human-altered habitats. Nakashima *et al.* (2013) found the availability of day-beds and fruit to be important factors affecting civet survival in such environments. Fragmentation of land habitats is extensive throughout most of the world, with its negative effects well documented (e.g. Saunders *et al.* 1991). The island of Java in particular has experienced vast deforestation in the past 200 years: now only 10% of the island is forested (Nijman 2013). To exemplify how Common Palm Civet adjusts to anthropogenic habitats, we report on its use of water-pipes as pathways in a largely deforested agroforest in West Java.

Study site

Cipaganti is a small village located on the foothills of an active volcano, Mt Papandayan, in West Java, Indonesia. Agriculture is a major source of income, predominantly rice supplemented by other crops. Therefore, research is performed within a mosaic of crop fields and villages, at 1,350–1,480 m altitude. The vegetation is characterised by introduced species that sparsely intersperse crop fields. Common crops include coffee, tea, chilli, carrot, cabbage and tomato. Other vegetation, mostly

introduced, includes *Eucalyptus*, *Calliandra calothyrsus* and several forms of bamboo. Rampant selective harvesting and large-scale clearing of bamboo and *C. calothyrsus* significantly limits canopy connectivity. For large-scale farming throughout the region, water-pipes have been installed by local farming communities, supplying water from distant ponds to the crop fields. The undulating terrain means water-pipes are often raised up to 12 m above the ground.

Methods

An ongoing Javan Slow Loris *Nycticebus javanicus* study placed a camera-trap at 7°16'49"S, 107°45'45"E (1,450 m asl) facing a water-pipe. This water-pipe was 142 m long × 32 mm outer diameter, with a 2.5 mm wall of hard, smooth PVC-style plastic. A thin metal wire ran along and about 2–3 cm above the water-pipe. These characters are typical of long water-pipes in this region. A Cuddeback 1187 IR Attack motion-sensor camera-trap was set 1.5 m off the ground, on a *Eucalyptus* trunk for seven nights from 19 February 2014. Three other camera-traps were active nearby during this period; one on a tree (2.5 m off the ground, model: Cuddeback 1187) and two at ground-level (model: Bushnell Trophy Camera Brown 119496). All camera-traps, once triggered, recorded one still image followed by a ten-second video. They reset after a lag of 30 seconds.

Results

The camera-trap facing the water-pipe recorded 29 photographs. In the same period, the other three camera-traps took none. The unit facing the water-pipe recorded seven instances of Common Palm Civet (Fig. 1) using the water-pipe to cross an open field. Twice in May 2014, during further camera-trapping at this water-pipe, a female and offspring moved on the pipe together, hopping over each other and grooming. All civets showed extreme agility on the water-pipe. They mounted and descended the water-pipe via trees. The quality of the camera-trap photographs does not permit the identification of



Fig. 1. Common Palm Civet *Paradoxurus hermaphroditus* walking on a water-pipe within a eucalyptus plantation. Cipaganti, Java, Indonesia, 17 February 2014 at 20h35.

individual civets, so it is unclear how many civets were photographed. There were five photographs of Javan Slow Loris, but none of any other mammal, crossing the water-pipe.

Conclusions and recommendations

Common Palm Civet is recorded regularly at Cipaganti, mostly in trees (Rode-Margono *et al.* 2014), but also frequently moving along the ground. Although often photographed above ground in trees (e.g. Low 2010), water-pipe use seems previously undocumented. The frequency at which photographs and video footage were taken combined with the animals' agility suggests that such use is common. This seems to be an adaptation to mosaic vegetation with limited arboreal connectivity. Placing camera-traps off the ground increases the chances of discovering arboreal civets. For instance, Wahyudi & Stuebing (2014) recorded Common Palm Civet only in trees during a 4½-year camera-trap study in East Kalimantan. Similar results were found at Cipaganti: the ground-level camera-traps recorded no civets despite three times the number of camera-trap-nights during the same period.

Once, a Slow Loris on the water-pipe was followed by a Common Palm Civet travelling in the same direction within one minute. We have seen no small carnivore at our site pre-date a Loris, although the Loris's size (900–1,100 g) suggests it could be possible prey for Common Palm Civet. Water-pipes might represent a vulnerable location for potential civet prey.

Palm civets use many different man-made structures. Common Palm Civet has been recorded to use telephone cable lines in Malaysia (Azlan 2003) and power lines in Singapore (Tan 2012), both of which are often thinner and less stable than are water-pipes. Additionally, it uses drains and sleeps on rooftops (SAFE undated). Small-toothed Palm Civet *Arctogalidia trivirgata* has been seen on roadside wires through forest (Duckworth & Nettelbeck 2008) and ropes on a ship (Stern-dale 1884). The use of wildlife bridges to enhance habitat connectivity and to prevent road kill and electrocution of (semi-) arboreal mammals has been widely documented (Weston 2003, Das *et al.* 2009, Teixeira *et al.* 2013). In Cipaganti, species such as rats (Muridae) and treeshrews *Tupaia* have been recorded using rope and rubber bridges suspended for Javan Slow Loris, but, surprisingly, to date no Common Palm Civet use has been observed (unpublished data).

Morphological adaptations might facilitate the use of water-pipes and other artificial pathways by Common Palm Civet. Arboreal carnivores have elongated manual phalanges enhancing their ability to grasp substrates whilst climbing (Samuels *et al.* 2012). Membranes between their digits increase the area of contact between the underside of their paws and the substrate surface. Furthermore, their low centre of gravity would enhance the animals' stability when walking along unstable or thin substrates.

The use of water-pipes by Common Palm Civet is further evidence of its heavy tolerance to human activity. Its widespread urban and suburban occurrence must place it on the front line for the civet-trade demand, yet there is no information of whether this is having any effect on the wild population. Common Palm Civet is an increasingly common sight in wildlife markets in Indonesia (Shepherd 2008, Nijman *et al.* 2014) where it is sold as pets and to supply farms producing

kopi luwak (civet coffee). An island-wide Common Palm Civet population survey would help understand changes in wild populations as a result of trade. This should preferably cover a variety of sites from synanthropic to remote ones.

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