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Rodents and some non-volant mammals of Mt. Tangkulan Range, Central Mindanao, Philippines

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Abstract

The Philippines is known for its diverse mammal fauna and its mammal assemblages with high endemism. The study provides information on the species richness, composition and status of rodents across vegetation types and other non-volant mammals in the in Mt. Pinamantawan, Tangkulan range. The mountain remains partly explored due to political instability and other security concerns. Inventory of rodents and other mammals in Mt. Pinamantawan, Tangkulan range documented 9 species distributed to 7 families, and 8 genera. Of these, five are endemic species and one vulnerable species. The mountain being haven to vulnerable and endemic species of rodents and other mammals, threatened by deforestation, habitat loss, primitive trapping and hunting calls for conservation efforts by the stakeholders.

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Introduction

The Philippines with its ca. 175 indigenous land mammal species and ca. 112 (ca. 64 %) endemic species and endangered species is perhaps with the greatest concentration of endemic mammals in the world (Heaney, 1986; Heaney and Regalado, 1998; Mittermeier *et al.,* 1997; Oliver, 1994; WCSP, 1997)**.**

The Philippines is known for its diverse mammal fauna and its mammal assemblages that are characterized by its high endemism of ca. 60 % (Heaney *et al.,* 1998).The murid fauna of the Philippines comprises a diverse assemblage of rodents which exhibit a wide array of morphological and ecological specializations (Heaney *et al.,* 1998; Musser *et al.*, 1998; Rickart *et al.,* 1998; Heaney *et al.,* 2006; Balete *et al.*, 2007). There are 22 genera with 56 species of murid rats that are native to the Philippines.

Rats are abundant in tropical forests due to different habitat preferences (Mallari & Jensen 1993, Heaney *et al.* 1998, Tabaranza *et al.* 2002). While its distribution is not directly influenced by elevation (Salibay & Luyon 2008), many of forests rodents are well adapted to pristine habitats, thus, destruction of forests threatens their survival (Heaney & Regalado 1998. Heaney *et al.* 1999, Tabaranza *et al.* 2002). Heaney (1995) assumed that invasion of exotic rat species in the Philippine forests can possibly result to extinction of the native species. Presence of endemic and invasive species of mammalsare forest condition indicators since the existence of endemic species can be threatened by unfavorable conditions (Goodman 1995). Further large populations of invasive species indicates ecological imbalance within the habitat (Lehtonen *et al.* 2001).

The Mt. Tangkulan range in Bukidnon, located at N 07° 45' E 125° 13' remains partly explored due to political instability and other security issues. Thus, this study provides information on the species composition and status of rodents across vegetation types and other non-volant mammals in the Mt. Tangkulan range, with a summit of 1701 m a.s.l.

Materials and methods

Permit Statement

Faunistic inventory were carried out in the Mt. Pinamantawan, Tangkulan range on Jun 2015 after the consent of the barangay captain, indigenous people mandatory representatives (IPMR), Certificate of Ancestral Domain Title (CADT) President and tribal chieftains were secured.

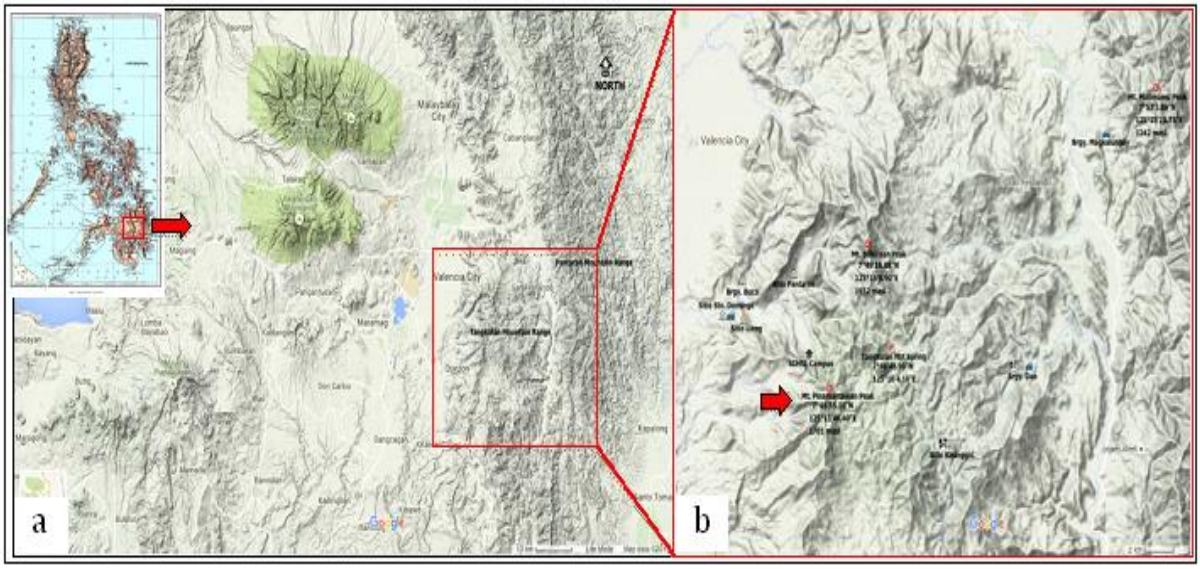

Fig. 1. Study Site Map. a) Map showing the Central Mindanao mountain ranges within Mindanao (red arrow and inset) (right quadrant), b) Mt. Pinamantawan, Tangkulan Range (red arrow).

Study Site and Stations

The Mt. Tangkulan range is geopolitically within Quezon and San Fernando Bukidnon, Philippines. Its topography ranges from moderately steep to very steep terrain. The study site is unexplored due to political instability and other security issues.

The study site is peopled particularly by the Manobo Kulamanon (people of the Kulaman River). The mountain range houses the networks of headwaters supplying the Kulaman River and the Salog River. The latter is tributary of the Pulangui River, which eventually drains into the Rio Grande de Mindanao.

The study established 3 trapping stations. Station 1 is a mossy, ca. 1670-1681 m a.s.l., close canopy, moderately sloped to very steep, mossy forest, less sunlight penetration, the dominant tree taxa are, *Cinamomum* sp., emergent trees up to 60 ft, 50 cm DBH, canopy epiphytes are *Oleandra* sp. and orchids, canopy vines are rattans (*Calamus* spp.) and *Philodendron* sp., understory plants are the tree ferns, *Musa textilis*, *Pandanus* sp. and *Pinanga* sp. (Arecaceae), ground cover plants are pteridophytes and grasses, *Musa* abundance 80%, *Nepenthes* abundance 100 %, moss density 100%, leaf litter abundance 80%, humus cover depth is ca. 6 inches, soil is wet loamy, 20 % exposed rocks, ca. 3-5 km away from water source.

Station 2 is a dipterocarp forest, ca. 1393-1494 masl, steep to very steep, close canopy, *Cinamomum* sp. and *Agathis* sp. are the dominant and emergent tree taxa up to 100 ft, 60 cm DBH, canopy epiphytes are *Oleandra sp.* and orchids, canopy vines are *Calamus* spp. and *Philodendron* sp., understory plants are the tree ferns, *Musa textilis*, *Pandanus* spp., *Freycenetia* sp. and *Pinanga* sp. (Arecaceae), ground cover plants are pteridophytes and grasses, *Musa textilis* abundance 100%, *Nepenthes* abundance 80%, moss density 20%, leaf litter abundance is 80%, humus cover depth is ca. 6 inches, soil is wet loamy, with exposed rocks, ca. 3 km away from water sources and anthropogenic area.

Station 3 is agroecosystem, ca. 1112-1130 masl, slope to moderately steep, *Cinamomum* sp. is the dominant tree taxa, canopy vines are *Calamus* spp. and *Epipremnum* sp. (Araceae), understory plants are the tree ferns, *Musa textilis*, *Pandanus* sp. and *Pinanga* sp. (Arecaceae), ground cover plants are pteridophytes and grasses, sedge abundance 80-100%, *Musa* abundance is 100%, moss density 20%, 80% exposed rocks, with water sources, abundant agricultural products such as maize, sweet potato, root crops and vegetables.

Live Trap Sampling and Data Gathering

Transect line of 100 m to 150 m were used in the trapping procedure, slightly adapted from Soliman *et al.* (2001) and Heaney *et al.* (1999). The transect lines were located 5-10 m from the main forest trail to ensure less disturbance. A total of 258 trap days/nights (48 trap nights/station) were installed to capture small mammals lured by banana, sweet potato and dried fish set before dusk and were checked at dawn. Single-capture live cage-traps (LCT) of 12 x 7 x 7 inches (30.5 x 17.8 x 17.8 cm) were used for trapping. The traps were marked with plastic or yarn to facilitate retrieval or resetting.

The study stations were hunting grounds of the locals where traps designed to capture rodents, wild boar, deer and game birds were observed. Presences of other non-volant mammals were indicated by the presence of tracks, droppings and whitening skulls.

Animals captured by the locals from the study site were duly photo documented *in situ* and measured with the consent of local hunters to supplement the data. Rodents captured by the local trappers using indigenous rodent traps were documented to supplement the data since various traps were observed within the study stations. To supplement faunal data visual encounter conducted at daytime and nighttime along the sampling stations were also done. Interview with the local hunters and primitive trappers were also done to document the presence of large mammals in the mountain range.

Rodents Morphometric, Identification and Preservation

The lengths of the tail, head and body and hind foot were taken with the use of dial caliper and a ruler. Rats were classified then identified using Heaney *et al.* (1999). Species identification was verified at the Zoology Division, University Museum, Central Mindanao University, Musuan, Bukidnon.

Voucher specimens were limited to one per species collected from the local hunters hunting in the area. Animals were handled following the animal care guidelines of the American Society of Mammalogists for the use of wild mammals in research (2011).

Captured, Marked and Released Method

The study employed captured, marked and released method using marker pens to obtain accurate count on number of individuals per station.

Results and discussion

Species richness and composition

Faunistic Inventory in Mt. Pinamantawan documented a total of ten species of non-volant mammals assigned to eight families and 9 genera. Of these, five species namely, *Exilisciurus concinnus, Limnomys sibuanus, Rattus everetti, R. exulans, Tupaia everetti* are rodents distributed among three families, Muridae, Sciuridae and Tupaiidae and four genera (Table 1).

Table 1. Species Richness and habitat preference of Rodents Captured in Mt. Pinamantawan.

	Species	Family	Common Name	Conservat'n Status	Ecological Status	Station 1	Station 2	Station 3
						No. of Individuals Captured		
1.	*Exilisciurus concinnus*	Sciuridae	Philippine pygmy squirrel	LC	Philippine Endemic	1*		
2.	*Limnomys sibuanus*	Muridae		LC	Mindanao Endemic	3*	2*	2
3.	*Rattus everetti*	Muridae	Common Philippine forest rat	LC	Philippine Endemic	2*	1	1*
4.	*Rattus exulans*	Muridae	Spiny rat	LC	SE Asia		1 /1*	
5.	*Tupaia everetti*	Tupaiidae		LC	Mindanao Endemic	1*	2	1*
	Total					7	7	4

Notes:* data from the indigenous rodent traps set by the locals

Station 1- Mossy forest, Station 2- Dipterocarp forest, Station 3 Agroecosystem

LC- Least Concern.

Table 2. Other Mammals in Mt. Pinamantawan, Tangkulan Range.

	Species	Family	Common name	Conservation status	Ecological status/distribution
1.	*Cervus mariannus*	Cervidae	Philippine brown deer	Vulnerable	Philippine Endemic
2.	*Cynocephalus volans*	Cynocephalidae	Philippine flying lemur		
3.	*Macaca fascicularis*	Cercopithecidae	Long tailed macaque	Lower Risk	SE Asia
4.	*Paradoxurus*	Viverriidae	Asian palm civet	Least Concern	SE Asia
5.	*hermaphroditus*				
6.	*Susphilippenensis*	Suidae	Philippine warty pig	Vulnerable	Philippine Endemic
7.	*Tarsius syrichta*	Tarsiidae	Philippine Tarsier	Data Deficient	Philippine Endemic

The mountain range is also a home to large mammals such as, *Sus philippinensis, Cervus mariannus, Paradoxurus hermaphroditus, Tarsius syrichta* and *Macaca fascicularis* (Table 2). The species richness is lower compared to Mt. Hamiguitan's protected area where 16 species of non-volant mammals were documented (Balete *et al.*, 2006). Other efforts in the area report only 8 species (Relox *et al.*, 2009).

The species figure is low compared to the 21 species of non-volant mammals in Mt. Kitanglad Range Nature Park (Heaney *et al.*, 2006).

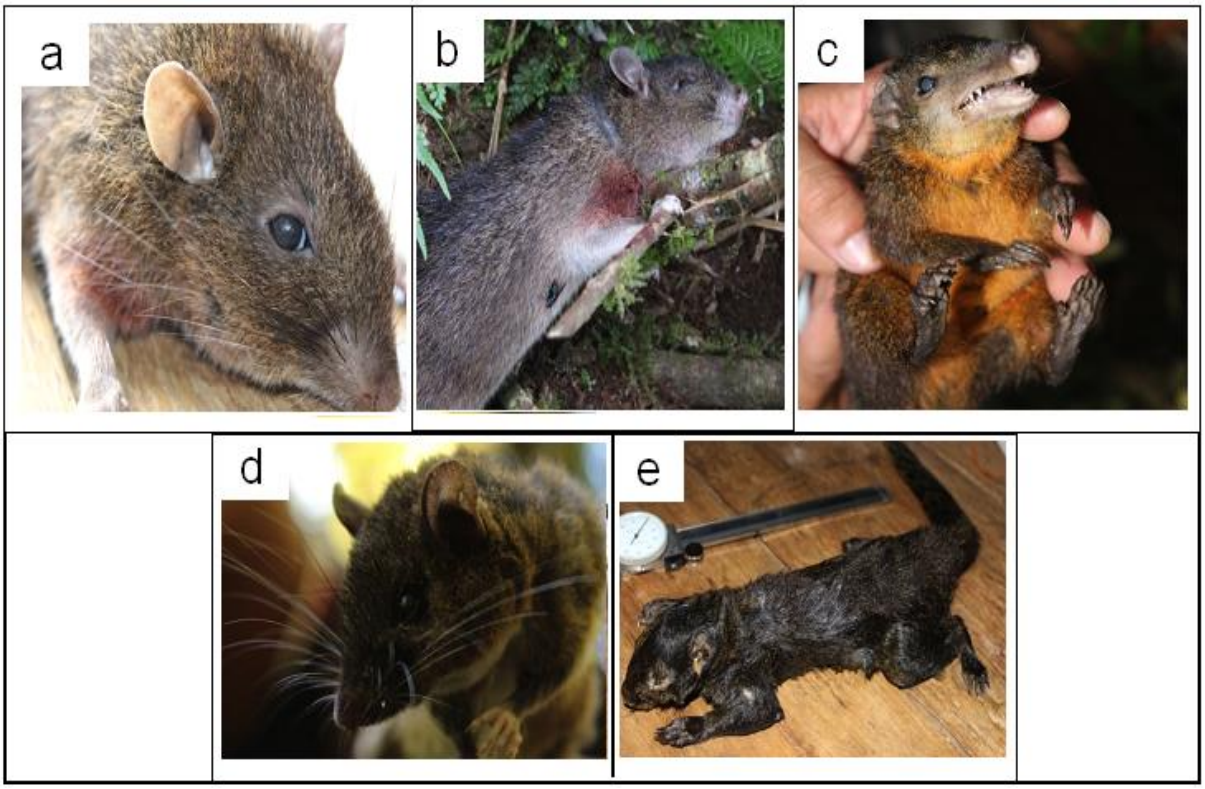

Fig. 2. Rodents in Mt. Pinamantawan, Tangkulan Range. a) *Rattus exulans*, b) *Rattus everetti,* c) *Tupaia everetti,* d) *Limnomys sibuanus,* e) *Exilisciurus concinnus.*
Note: animals in the photograph were captured by the indigenous rodent traps set by the locals.

The mossy and the dipterocarp forest harbors more species compared to agro ecosystem, which conforms to Heaney and Regalado (1998) that Philippine mammals prefer natural forest habitat.

The level of disturbance apparently influences the species distribution along the three vegetation types, confirming Ricart *et al.*'s (1993) findings that native species are most diverse in undisturbed habitats and decline in diversity with increasing disturbances. Further, species richness for small mammals increase with elevation (Rickart *et al.*, 1993).

The rodents prefer the mossy habitat because it can cater their needs for survival. Further Heaney & Regalado (1998), Heaney *et al.* (1999), and Tabaranza *et al.* (2002) cites that rodents prefer pristine habitats and are thus threatened by deforestations. Rodents together with other mammals in the Mt. Tangkulan range are trapped and hunted for food and as pest control to the local's swidden farms.

Conclusion

Faunistic inventory in the Mt. Pinamantawan revealed a total of five rodent species distributed among four genera and three families. Other species are *Macaca fascicularis, Cervus mariannus, Paradoxurus hermaphrodites* and *Sus philippinensis*. The species endemicity for rodents is 80 % with all the species classified under Least Concern by the IUCN. The mountain being haven to four endemic species of rodents and other mammals which are threatened by deforestation, primitive trapping and hunting calls for conservation efforts by the stakeholders.

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