

**Sole record of a Sumatran Rhinoceros**  
*Dicerorhinus sumatrensis harrissoni*  
**in Sungei Ingei Conservation Forest, Brunei Darussalam**

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**Abstract :** An individual Sumatran Rhinoceros was identified via camera trapping during the Sungei Ingei Faunal Biodiversity Survey from 2010-2012. This *in-situ* survey involved the deployment of 82 camera traps with a trapping effort of 51,202 trap-nights and of 9,502 independent samples of mammals obtained, with an exclusive sole image depicted a rhinoceros. The continued camera trapping survey over the three years did not yield any more evidence of its presence as the position of the camera traps were not rhino-focused but distributed over a large area to document all wildlife which was the primary purpose of the Survey. The single image obtained from such intensive camera trapping suggests a few possibilities - not more than a single individual was present or it was a surviving straggler or a member of a very dispersed population. This discovery was not revealed for the last 15 years owing to the rampant poaching in the country during the time when it was discovered. A fresh field search for the Sumatran Rhinoceros is the only way to ascertain whether there is any surviving at present, or if it was the last rhinoceros in Brunei.

**Keywords:** Sumatran Rhinoceros, Bornean Rhinoceros, Ingei Conservation Forest, extinction, Critically Endangered

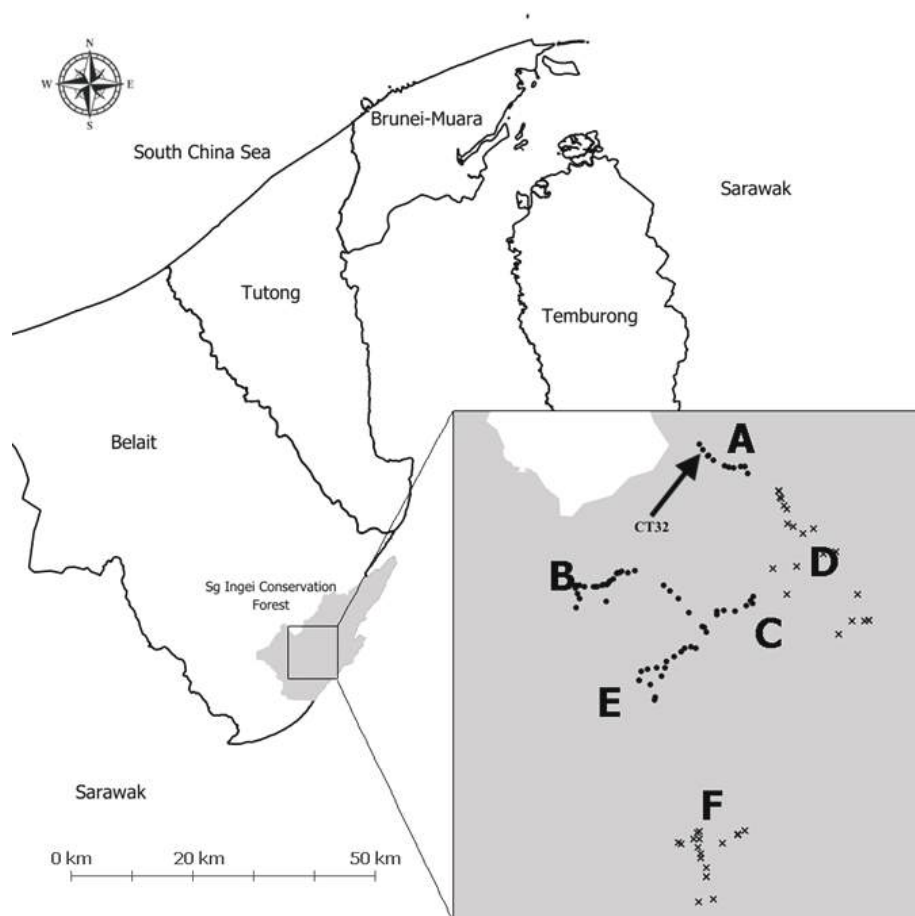
## INTRODUCTION

The Sumatran Rhinoceros *Dicerorhinus sumatrensis* was a Pleistocene relic from Sundaland (Cranbrook and Piper 2007). The Bornean Rhinoceros, or Hairy Rhinoceros (*Dicerorhinus sumatrensis harrissoni*) that was once found in the forests of Southeast Asia is the subspecies of the Sumatran Rhinoceros *Dicerorhinus sumatrensis* (Groves 1965). This was supported by the rhino genome sequencing work which showed a divergence between the Bornean and Sumatra-Malaya forms, commencing around 300,000 years ago (von Seth *et al.* 2021).

This is the most forest adapted species of all the five living species of rhinos, feeding almost entirely on leaves and stems of woody plant species, seedlings and some species of fallen fruits (Payne and Francis 1985; Payne 2022). In prehistoric times this was the Southeast Asian rhino that was distributed from North-eastern India and South-western China to Borneo and Sumatra. The global assessment of this species according to the IUCN Red List of Threatened Species (Ellis and Talukdar 2020) is Critically Endangered and is now extinct in most of its original range including Malaysia and Brunei besides Bangladesh, Bhutan, Cambodia, India, Lao People's Democratic Republic, and Vietnam. The Hairy Rhinoceros that was once widespread in Borneo (Medway 1977) is now considered extinct in the wild in Sabah after the death of the last female in 2019. There is no recent information to determine if any survive in Kalimantan. The subspecies *Dicerorhinus sumatrensis sumatrensis* which occurred in Thailand, Peninsular Malaysia, and Sumatra now occurs wild only in the Mamas valley in Aceh (pers. comm. Payne).

The discovery of this rhino occurred during the Faunal Biodiversity Survey (2009 – 2012) were conducted in the hitherto untouched pristine forest of Sungei Ingei Conservation Forest, during the World Wildlife Fund-sponsored Heart of Borneo initiative in Brunei Darussalam. It was during this period when forest ecosystems in Borneo were facing extensive anthropogenic disturbances (e.g., large-scale commercial logging, forest conversion into plantations, and clearing of forests for development) with consequential biodiversity losses (Kinnaird *et al.* 2003; Sodhi *et al.* 2004), that this discovery offered a glimmer of hope, or perhaps an existence of another isolated subpopulation of this Critically Endangered species in Brunei Darussalam.

Borneo, a global mega-biodiversity hotspot with a wild land mammal biodiversity of 247 species (including 100 bat species) and 63 endemic species (Phillipps and Phillipps 2016) has Brunei Darussalam, the smallest state on the island (Figure 1), with an extensive forest cover of 54% unlogged primary forests (Bryan *et al.* 2013) when compared to 18% remaining in Sabah and Sarawak and 40% of the remaining forest showing degradation (Gaveau *et al.* 2014). Besides studies of small mammals (Charles 1994, 1996; Charles and Ang 2006; Kofron 2002; Struebig *et al.* 2012), there has been no mammal inventory available for any forest in Brunei Darussalam. The Faunal Biodiversity Survey in Sungei Ingei Conservation Forest was a systematic inventory survey for mammals and other faunal taxa. The results of the Faunal Biodiversity survey have been documented (Charles 2012). We report here the discovery of the Critically Endangered Sumatran Rhinoceros in this forest recorded for the first time in 2010.



**Figure 1.** Map of Brunei Darussalam showing the position of Sungai Ingei Conservation Forest. The inset shows the 6 areas of camera trapping and the position of the trap CT32 that captured the image of the rhino.

## MATERIALS AND METHODS

### Study area

In the southeastern part of Belait District (Figure 1) close to the border hills abutting with Gunung Mulu National Park, Sarawak, lies the Sungai Ingei Conservation Forest (18,491 ha.) a pristine primary forest situated within the Labi Forest Reserve (1,198.8 km<sup>2</sup>). Sungai Ingei with a mosaic of interdigitating lowland dipterocarp forests, riverine, tropical heath (*kerangas*), wet heath (*kerapah*) forests with patches of freshwater and peat swamp in the lower valleys, was designated as a Conservation Forest and specially preserved for scientific, educational and research purposes (Forestry Department Ministry of Industry and Primary Resources 2011)

### Camera-trapping

Eighty-two camera traps were deployed with passive infra-red motion sensitive incandescent flash type (Wild-Eye Remote Camera Trap System by Wildtrack Services: trigger speed = 0.3 seconds, detection angle = 60 degrees, detection range = 30 feet, interval = 10 seconds between events, resolution = 4.1 megapixels), which were set from 2010 – 2012 in six areas of the mosaic forest (Sites A – F) and were left undisturbed for three to four months in different habitats (Figure 1). These camera traps produced clear, brilliant night and daytime images. They were positioned on trees about 40 – 60cm above the ground and set as single units to operate throughout a 24-hour cycle without any baits or scent lures. Positions of camera traps were recorded by Garmin GPSmap 62SC and extreme care was taken that none of the sites were disturbed.

## RESULTS

### Forest types and vegetation in camera trapping areas

**Area A:** Mixed Dipterocarp Forest (MDF). with *Shorea* spp. and *Mangifera* spp. was on the ridges and freshwater swamp occurred in the lowland with Eyul palm *Pholidocarpus maiadum*.

**Area B:** This site was a mosaic of Kerapah with pitcher plants *Nepenthes ampullaria*, peat swamp with another species of pitcher plants *Nepenthes bicalcarata*, tall dominant *Shorea albida*, while the ridge top with Kerangas dominated by *Agathis borneensis*.

**Area C:** This site had ridges with hill MDF dominated by *Dryobalanops beccarii* and giant *Shorea curtisii*, *Dipterocarpus* spp., a slope with Kerangas terrace dominated by *Agathis borneensis* and *Dipterocarpus* spp. and a wet lowland habitat near Belait river with an aggregation of *Dryobalanops lanceolata* fringed by *Dryobalanops aromatica* and Eyul palm *Pholidocarpus maiadum*.

**Area D** was an extension of Area C with similar vegetation.

**Area E:** The ridges and slopes were dominated by *Dryobalanops beccarii*, *Shorea curtisii* and *Hopea* spp (Bencaloi) while the slopes have a new *Licuala* spp.

**Area F** was an extension of Area E with similar vegetation.

### Trapping-effort

The trapping effort in terms of trap-nights for each area was as follows: Area A = 6,347; Area B = 13,271; Area C = 4,616; Area D = 7,686; Area E = 12,694 and Area F = 6,588, totaling 51,202 trap-nights. With that trapping effort during Phase 1 of the survey, 32,553 digital images were obtained of mammals and birds, of which there were 9,502 independent samples of mammals and 1,738 independent samples of birds.

### **Identification of the image**

Of 9,502 independent samples of mammals, only one image of the Bornean rhinoceros (Figure 2) was obtained in Area A in camera trap No. CT32 on 15 July 2010 at 1355 hours. Figure 3 shows the position of a prop root X and sapling Y just before the animal appeared (1355hrs). Figure 4 shows that after the animal has rushed past the camera-trap at 1355hrs, it smashed through the prop root (denoted as X) isolating the sapling (denoted as Y). Hence, the image (Figure 2) is not very sharp, but the skin fold near the shoulder is clear and the ear and throat region are visible. The image was identified as the Sumatran Rhinoceros by a rhino expert (Stephen Hogg, pers comm).

The possible reason for only one image of the rhinoceros obtained, were highly attributed to the deployment of most of the ten camera traps positioned along a ridge and a few on the lowland, where there were shrubs, freshwater swamps, wallows and streams. It is possible more images could have been obtained had more cameras been placed in the lowland. Besides, Area A was situated to the northeast of the other areas and separated by Sungei Ingei. So, it is highly unlikely for the rhino to be photographed by other camera traps along the other areas.

### **Information gathered from a hunter at the Melilas longhouse**

An interview was conducted with an elderly Iban hunter from the longhouse at Melilas, which is situated about 14 km from the Sungei Ingei Conservation Forest. This hunter used to hunt rhinos in this forest in the 1950s when there was no gun law in force in Brunei Darussalam. He reaffirmed it was a cryptic animal which used to run deep into the dense foliage when disturbed. He identified the image as a rhino that he was familiar with about 60 years ago.



**Figure 2.** The rhino at 1355 hours as it rushed past the camera trap. The image depicts movement – ear is a double image seen but the skin fold at the shoulder and the throat region are very clear.

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**Figure 3.** The position of the prop root X and sapling Y at 1355 hours just before the rhino appeared.



**Figure 4.** The prop root X has been smashed isolating the sapling Y as the rhino dashed through the vegetation.

## DISCUSSION

The extensive distribution of the Sumatran rhinoceros, which was the Southeast Asian rhino in historical times, decreased markedly during the last thousands of years through successive local extinctions as a result of expansion of human population, loss of optimal rhino habitats and demand by China for rhino products for several millenia. The path to extinction for the Sumatran rhino was slow and well documented and about a century ago remnant clusters of this species were scattered in areas with small sparse human populations and extensive closed-canopy forests as in Sumatra, Malay Peninsula and Borneo. Eventually mortality rate exceeds birth rate even in the absence of poaching and presence of suitable habitats. All Sumatran rhino deaths in recent decades, where the cause was known, were linked to kidney failure in males, and reproductive tract pathology, especially leiomyomas in females. Factors that exacerbate extinction and efforts in captive breeding have also been discussed thoroughly by Payne *et al.* (2025).

Today, few individuals if any, may survive in East Kalimantan and others in the Mamas valley in Aceh. One question remains: Is the sole record of the Sumatran rhinoceros in Brunei the last survivor?

A single image from an extensive camera trapping effort also suggests a few other possibilities: Not more than a single individual was present or it was a surviving straggler or a member of a very dispersed population.

Following the scientific method, the approach to answer the question should be an extensive ground search to scour the area with camera traps where the image was obtained and the region, looking for two valid signs: clear footprints and faeces, which are unique and positive (Payne 2022). Areas to search should include wallows, mineral licks, streams and vegetation eaten by rhino. Water samples collected from wallows and streams should be examined for rhino eDNA. In the event that after a thorough field survey and laboratory analyses there are no positive signs, then it may be said that the rhino photographed in 2010 in the Sungei Ingei Conservation Forest was the last rhino for Brunei Darussalam. But if there is a clear positive indication of the presence of a rhino or rhinos, further studies need to be pursued regarding their distribution, health and population ecology.

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