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Uncovering the true history of Dulit Partridge *Rhizothera dulitensis* to re-evaluate its conservation status

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Summary.—Dulit Partridge *Rhizothera dulitensis* is an enigmatic galliform endemic to the Bornean highlands. Usually, the species is reported as having been collected at four localities (three in Sarawak, one in Sabah) and as recently as the 1930s. However, a review of the evidence (just eight known specimens) finds that it can be confirmed at only three sites, and the whereabouts of one of these has previously been misunderstood. Moreover, the specimens were procured over just eight years, between 1894 and 1902, with recent suggestions of the species' collection in the 1930s probably a misinterpretation of a single source. With more than 120 years since the last record, there is no information on its current population size and trend, such that *R. dulitensis* is probably best listed as Data Deficient on the IUCN Red List. Surveys of little-explored parts of its presumed range, especially those furthest from habitation, are urgently required.

The genus *Rhizothera* G. R. Gray, 1841, is currently treated as comprising two species: Long-billed Partridge *R. longirostris* (Temminck, 1815) of lowland and submontane Sundaland (the Thai-Malay Peninsula, Sumatra and Borneo), and Dulit Partridge *R. dulitensis* Ogilvie-Grant, 1895, in montane Borneo. The latter is a true enigma thought to be known from specimens taken at four localities, three in Sarawak and one in Sabah (Mann 2008), all in the late 19th and early 20th centuries. There have been no subsequent confirmed records (Eaton *et al*. 2021, MNS Bird Conservation Council 2021, eBird 2022), despite renewed interest in Sarawak as a birding destination (see Orenstein *et al*. 2010).

Although described as a species by Ogilvie-Grant (1895) from two specimens collected by C. Hose in 1894, Peters (1934) and Chasen (1935) considered it a subspecies of *R. longirostris*. Their arrangement persisted for decades, thus it was not included, for example, in Collar *et al*. (2001). *R. dulitensis* was resurrected to species rank by Davison (1999) in a note justifying his taxonomic decisions as editor of Smythies (1999), which has now garnered universal favour among regional and global taxonomic authorities (Mann 2008, Dickinson & Remsen 2013, del Hoyo & Collar 2014, Eaton *et al*. 2016, 2021, Clements *et al*. 2022, Gill *et al*. 2022).

Separation from *R. longirostris* is possible only in adult male plumage (Fig. 1), with *dulitensis* having a white (not pale rufous) belly, a much broader (10 vs. 6 cm) grey breast-band and no buffish wing-covert patch (Davison 1999, del Hoyo & Collar 2014). The two may prove to juxtapose one another elevationally, with *longirostris* on Borneo occurring only in the lowlands and specimens of *dulitensis* collected at *c*.900–1,200 m (Mann 2008).

For most of the 20th century, *R. dulitensis* was summarised as being known from just two localities, both in Sarawak: Mt. Dulit, whence the two syntypes came (Ogilvie-Grant 1895, 1896) and Batu Song (Banks 1937a,b, Smythies 1957). However previously overlooked specimens have relatively recently confirmed the species on Mt. Murud in Sarawak (Davison 1999) and Mt. Kinabalu in Sabah (Davison 2007, 2008). The evidence pertaining to these localities and to reports from the 1930s has never been scrutinised.

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Figure 1. Comparison of four specimens of Dulit Partridge *Rhizothera dulitensis* (left) with four Long-billed Partridges *R. longirostris* (right) at the Natural History Museum, Tring (NHMUK), from left to right: *dulitensis* NHMUK 1894.8.2.1, 1900.2.14.40, 1900.2.14.41, 1969.32.2; *longirostris* 1924.4.18.4, 1904.5.30.3, 1889.5.13, 1901.5.1.2 (Alex J. Berryman, © Trustees of the Natural History Museum, London)

What are the known sites for Dulit Partridge?

R. dulitensis is known only from specimen material (Mann 2008, Eaton *et al*. 2021). Galliform specimen data were collated from 135 museums by Boakes *et al*. (2020; see their Table 2), who identified a total of seven specimens of *R. dulitensis*. They overlooked an eighth specimen, the male syntype, housed at the Natural History Museum, Tring (NHMUK 1894.8.2.1). The Sarawak Museum, Kuching, was not checked by Boakes *et al*. (2020) but does not hold any *dulitensis* (specimens labelled as *R. longirostris* were also checked) (A. S. Naqiuddin *in litt*. 2022). All Bornean *R. longirostris* records and specimens identified by Boakes *et al*. (2020) are unambiguously from the lowlands and certainly involve *longirostris*. Consequently, the eight specimens of *R. dulitensis* (Table 1) appear to represent our only knowledge of the species.

Based principally on published summaries (Banks 1937a, Smythies 1957, 1999, Davison 1999, 2008), the contemporary literature concurs in listing four localities at which the species has apparently been collected (e.g., Mann 2008, Myers 2016, del Hoyo *et al*. 2020, Eaton *et al*. 2021, BirdLife International 2022): three (Mt. Murud, Batu Song and Mt. Dulit) in Sarawak and one (Mt. Kinabalu) in Sabah. These four localities (Fig. 2) are discussed, from north to south, below.

Mt. Kinabalu, Sabah.—The presence of *R. dulitensis* in Sabah was overlooked (e.g., Smythies 1957, Gore 1968, Smythies 1999, Sheldon *et al*. 2001) until three specimens—not one, as reported by Phillipps & Phillipps (2014), nor two, per Orenstein *et al*. (2010)—were found by Davison (2007, 2008). Two (an immature female, NHMUK 1898.12.8.75, and an immature male, NHMUK 1969.29.18) are held in Tring whilst the third, an adult male, is at the American Museum of Natural History, New York (AMNH 511976). All three were collected by Alfred H. Everett in October 1895, and Davison (2008) postulated that they may

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TABLE 1
A list of all known specimens of *Rhizothera dulitensis* in date of collection order. Data are from specimen labels. 'Other notes' includes possible corrections.

Accession No.	Locality	State	Year	Month	Sex	Age	Collector	Other notes
NHMUK 1894.8.2.2	Mt. Dulit, 4,000 ft.	Sarawak	1894	February	Female	Adult	C. Hose	Female syntype.
NHMUK 1894.8.2.1	Mt. Dulit, 4,000 ft.	Sarawak	1894	March	Male	Adult	C. Hose	Male syntype.
NHMUK 1898.12.8.75	Mt. Kinabalu	Sabah	1895	October	Female	Imm.	A. H. Everett	
NHMUK 1969.29.18	Mt. Kinabalu	Sabah	1895	October	Female	Imm.	A. H. Everett	Labelled female but has plumage features consistent with an immature male (Davison 2008; AJB pers. obs.).
AMNH 541976	Mt. Kinabalu	Sabah	1895	October	Male	Adult	A. H. Everett	
NHMUK 1900.2.14.40	Mt. Dulit	Sarawak	1898	October/ December	Male	Adult	C. Hose	Original label says October; newer label December.
NHMUK 1900.2.14.41	Mt. Dulit, 3,000 ft.	Sarawak	1898	December	Male	Adult	C. Hose	
NHMUK 1969.32.2	Mt. Murud, 4,000 ft.	Sarawak	1902	April	Male	Adult	C. Hose	Locality more likely to refer to Murud Kecil than Mt. Murud, but provenance ultimately unknown.

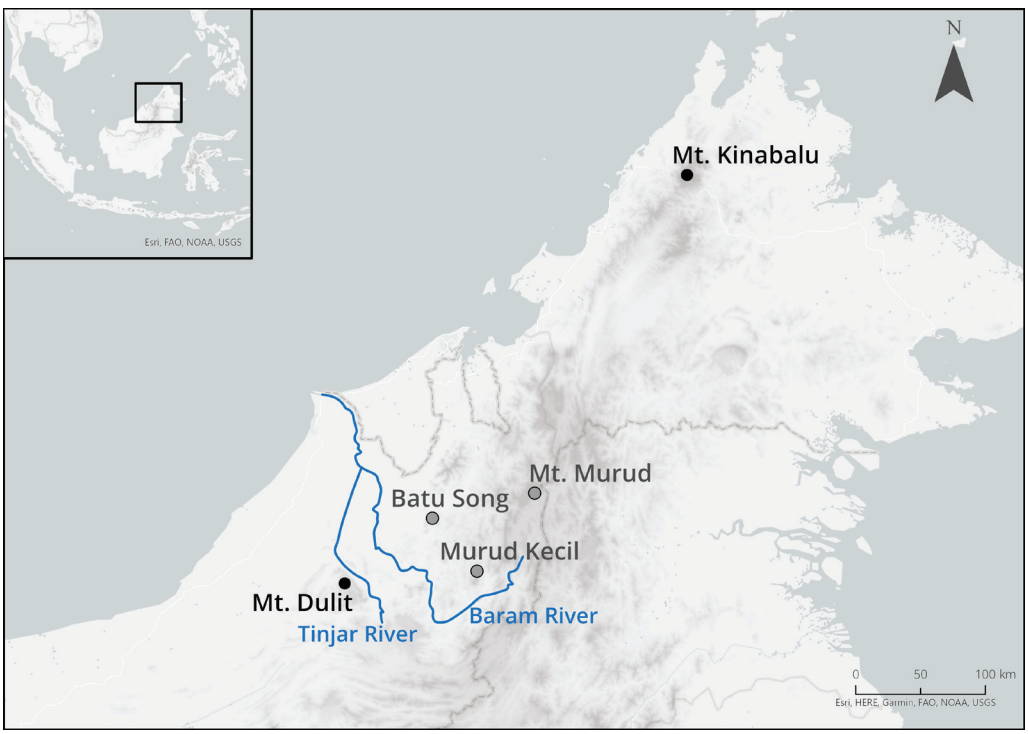

Figure 2. Sites and landmarks mentioned in the text. Black text = confirmed localities of Dulit Partridge *Rhizothera dulitensis*, grey = unconfirmed.

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have been a family group taken together. They represent the only confirmed occurrence in Sabah.

Mt. Murud, Sarawak.—Earlier contributions (e.g., Banks 1937a, Smythies 1957) did not list Mt. Murud as a locality for *R. dulitensis* but Davison (1999) noted that 'one skin in NHM, Tring' was obtained there. The specimen in question (NHMUK 1969.32.2) was collected by Charles Hose in April 1902 and, based on a newer label, was said by Boakes *et al*. (2020) to be from 'Baram, Sarawak'. However, the specimen bears an original label that reads 'murud mt 4000 ft April 1902 ♂', with the newer label having been transcribed only with the much larger text at the top of the older label referring to the district.

It is, however, unlikely the specimen was collected at Mt. Murud. Located in erstwhile Limbang district, Mt. Murud is on the Sarawak / Kalimantan border (see Fig. 2) and, as the tallest peak in Sarawak, was the subject of considerable interest in the early 20th century. Although Hose notoriously lacked diligence as a record keeper (see Durrans 1994; and discussion below), it seems unlikely that he would visit a location of such distinct interest and fail to mention collecting on or near it in any of his work (Hose 1900, Hose & McDougall 1912, Hose 1927, 1929). Furthermore, most of Hose's endeavours were in Baram district, where he was stationed, and in regions accessible via the Baram and Tinjar Rivers (Hose 1927; see Fig. 2); Mt. Murud would have represented a significant extension of his efforts. The notion that Hose (or his collectors) did not visit Mt. Murud is also reinforced by his contemporaries. Both Mjöberg (1925) and Banks (1937a,b) regarded J. C. Moulton as the first collector to visit this region in 1914, although he was unsuccessful in getting beyond the head of the Akar River. Documenting his own (successful) visit to Murud's summit in October–November 1922, Mjöberg (1925: 415) wrote 'Up to 1922, therefore, Mt Murud and the Kalabit country were unknown from a scientific point of view; Mt Murud itself had been seen only at a distance by some few Europeans and had never been approached'. Since these explorations were made several years after Hose departed Sarawak (Hose 1927), it is extremely improbable that NHMUK 1969.32.2 was collected there.

A detailed sketch map of Baram district produced by Hose in 1900 and held at the National Archive of Singapore (Fig. 3) shows he used the name 'Batu Murud' for a mountain now usually known as Murud Kecil ('Little Murud'). This peak is much smaller (1,626 m vs. 2,424 m) and *c*.80 km south-west of Mt. Murud. At its base lies the Selungo River, a navigable channel that links to the Baram River just 15 km to the south. It therefore seems more likely that Hose collected NHMUK 1969.32.2 at Murud Kecil rather than Mt. Murud as has been assumed, and mapped (del Hoyo & Collar 2016, Myers 2016, Eaton *et al*. 2016, 2021, Puan *et al*. 2021, BirdLife International 2022).

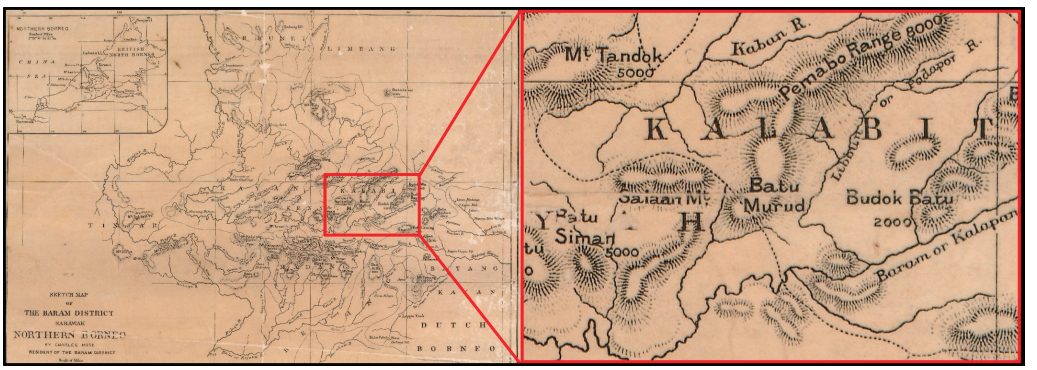

Figure 3. Sketch map of Baram district, Sarawak, produced by Charles Hose in 1900. Reproduced with permission of the National Archives of Singapore.

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Batu Song, Sarawak.—This locality was first mentioned for *R. dulitensis* by Banks (1937a), however no *dulitensis* specimen label bears its name. Banks (1937a) provided no information on the origin of the record but in summarising collecting efforts (including his own) from the Sarawak highlands, he asserted (p. 476) that only Hose had ever collected on Batu Song, a fact also implied in Banks (1937b: 500). Hose collected on Batu Song in 1892—as evidenced by, for example, specimens of Great Argus *Argusianus argus* and Black Partridge *Melanoperdix niger* at NHMUK (Boakes *et al*. 2020), and by its mention as a locality for 13 mammal species in Hose (1893a)—but this was two years before the *R. dulitensis* syntypes were taken. While it is plausible that Hose revisited Batu Song after 1892, he nowhere mentioned doing so (Hose 1900, Hose & McDougall 1912, Hose 1927, 1929) and the specimen(s) of *R. dulitensis* supposedly collected there cannot be traced, despite checks of the inventories of all museums to which he sent specimens directly (Boakes *et al*. 2020; see Appendix 7 in Hose 1927). It is notable that Banks (1937a) did not list Mt. Murud or Murud Kecil as a locality for the species, leaving open the possibility that, correctly or incorrectly, he regarded the 'Murud' specimen (NHMUK 1969.32.2) as having been obtained on Batu Song. However, Hose's movements in Sarawak are incompletely known, with no diary or field notes having been found, despite suggestion he did (at least for some of his years on Borneo) keep them (Durrans 1994). Consequently, in the absence of any specimen or other evidence of *R. dulitensis* having been collected on Batu Song, this record is treated here as unconfirmed.

Mt. Dulit, Sarawak.—Although initial collecting efforts on Mt. Dulit did not find the species (Hose 1893b,c), in 1894 Hose obtained the two specimens used by Ogilvie-Grant (1895) to describe it. The female (NHMUK 1894.8.2.2) and male (NHMUK 1894.8.2.1) syntypes are labelled as having been collected in February and March respectively. Nearly five years later, in December 1898, Hose revisited Mt. Dulit, presumably during his travels for Hose & McDougall (1901), and collected two more adult males (NHMUK 1900.2.14.40 and 1900.2.14.41). Puzzlingly, he identified the former as *R. longirostris*, recording on the label that it was 'perhaps intermediate between *R. longirostris* & *R. dulitensis*'. However, the specimen does not differ appreciably from the other three adult male *R. dulitensis* at NHMUK (AJB pers. obs.), including that (NHMUK 1900.2.14.41) collected at the same or a similar time, and the basis of his remark is obscure.

When was the most recent record?

Neither Smythies (1999) nor Mann (2008) recorded when *R. dulitensis* was last collected, but Orenstein *et al*. (2010) asserted that it was in 1937. This has been repeated in subsequent literature, either as 'in the 1930s' (del Hoyo *et al*. 2020, Puan *et al*. 2020), 1936/1937 (Eaton *et al*. 2021) or 1937 (BirdLife International 2022). It appears that the date of the last significant publication on the species was mistakenly noted as the final observation. In reality, Banks (1937a) nowhere claimed to have collected any specimens himself, nor did he provide evidence that anyone other than Hose had ever collected the species in Sarawak.

The eight known specimens reported herein (Table 1) were all collected during an eight-year window between 1894 and 1902. In the absence of additional specimens or other evidence since, the last known record of *R. dulitensis* must be regarded as 1902.

Subsequent effort and claims

Sabah.—Davison (1999) noted that Comber (1971) referred to *R. longirostris* in a list of native bird names compiled from 'about 550 m altitude in fairly level country' in the vicinity of Sapong Estate, Sabah. Given that *dulitensis* was regarded a subspecies of *R. longirostris* at

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the time, Davison (1999) concluded that 'it cannot be determined which taxon was meant'. Nonetheless, Davison (2008) appeared to attribute it to *R. longirostris*, whereas Phillipps & Phillipps (2014), without additional evidence, inferred that *R. dulitensis* was involved. G. W. H. Davison *in* Smythies (1999) additionally suggested that there were records of *Rhizothera* from near Tenom, in the Crocker Range, Sabah, the identity of which had 'not been determined precisely' but no additional information is given. There have been no claims from Sabah since (J. A. Eaton *in litt*. 2022).

Although Mt. Kinabalu is the most frequently visited montane birding site on Borneo, the park's headquarters are on the mountain's southern side at *c*.1,600 m, from which visitors typically proceed to higher elevations (there is no longer forest directly below it). As suggested by Davison (2008), the elevation visited by most may therefore be too high for *dulitensis*. Nonetheless, forest at 900–1,200 m does remain on the mountain's little-visited northern and eastern flanks.

Sarawak.—Expeditions to Mt. Dulit in the 1930s (Harrisson 1933) and the Kelabit Highlands in the 1940s and 1950s (see Sheldon *et al*. 2013) failed to find *R. dulitensis*, as have more recent trips (e.g., Gregory-Smith 1988, Wang 2004, Sheldon *et al*. 2019).

A photograph of a *Rhizothera* with its underparts obscured and a locality of 'Sarawak' (Cubitt & Payne 1999) was taken in the lowlands near Kuching (G. Cubitt *in litt*. 2022). The location, in addition to the conspicuous buff wing-coverts (most visible in another, unpublished, photograph), means this record can be attributed to *R. longirostris* (AJB pers. obs.).

Recently, Sarawak has received renewed interest from birders and amateur ornithologists (see Orenstein *et al*. 2010), mainly focused on the Kelabit Highlands around Ba'kelalan on the lower slopes of Mt. Murud, and Paya Maga (eBird 2022), where other regional endemic and near-endemic species are easily seen. Although these sites are at a suitable elevation for *R. dulitensis*, they are also likely to be under hunting pressure given their proximity to villages, whilst short visits to roads and wide trails are unlikely to yield sightings of a species that is probably, if like its congener, highly elusive. A lack of knowledge of its vocalisations also hampers search efforts. Certainly, there have been no sightings (confirmed or suspected) in this area, despite a six-day trip to more remote disused logging tracks around Ba'kelalan in 2009–10 (J. A. Eaton *in litt*. 2022). Expeditions elsewhere in the Kelabit Highlands in 2011 reported in Sheldon *et al*. (2019) describe degraded habitats likely to be suboptimal for the species. While from a biogeographic perspective the species can be expected to occur in the Kelabit Highlands, it should be noted that, following removal of Mt. Murud as a locality, *R. dulitensis* has never definitively been collected there.

Elsewhere, between March 2004 and September 2008, field work principally for mammals (e.g., Mathai *et al*. 2014) in the Upper Baram (north of the Baram River, directly south of Murud Kecil), in forest at elevations spanning 300–2,000 m, yielded no sign, despite effort totalling *c*.790 km of diurnal walked transects and more than *c*.5,250 days of camera-trap data (D. Kong *in litt*. 2022). Three two-week visits to the same region in 2007 for bird surveys had the same outcome, but did yield sightings of other elusive galliform species including Bulwer's Pheasant *Lophura bulweri* (D. Kong *in litt*. 2022).

Visits to Mt. Dulit targeting *R. dulitensis* in 2010, 2012 and 2018 (totalling 17 nights) did not find the species (Y. S. Teck & J. A. Eaton *in litt*. 2022), and local hunters were not familiar with illustrations of it, nor of vocalisations of *R. longirostris*, despite good knowledge of all other Galliformes (J. A. Eaton *in litt*. 2022). Similarly, a four-night visit to Long Lellang (on the northern flank of Murud Kecil) in 2010 (J. A. Eaton *in litt*. 2022) and three two-week trips to the same area in 2012 (D. Kong *in litt*. 2022) did not find *R. dulitensis*, nor did a two-week

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expedition to Usun Apau National Park (*c*.50 km south-east of Mt. Dulit) in 2021 (D. Kong *in litt*. 2022).

Kalimantan, Indonesia.—Although *R. dulitensis* was never collected in Kalimantan, it seems inevitable that the species occurs there given contiguous forest spanning the Bornean Central Highlands. Ornithological effort has been minimal compared to Sabah and Sarawak. Nonetheless, the Kalimantan side of the Kelabit Highlands, including Kayan Mentarang National Park, has been explored several times at elevations ostensibly suitable for the species without any record (Pfeffer 1960–61, van Balen & Aspinall 1996, van Balen 1997, 1999, van Balen & Nurwatha 1997, Sebastian 2007; G. W. H. Davison *in litt*. 2022). Exploration of the Barito Ulu region, including six days at 800–1,000 m (Wilkinson *et al*. 1991), and of the Menyapa Mountains, including four days at 500–1,500 m (Brickle *et al*. 2010), did not find the species, despite both expeditions reporting other secretive Galliformes including Bulwer's Pheasant and Black Partridge.

Current status and future work

Having feasibly gone unobserved by scientists for more than 120 years, attention must pivot to where *R. dulitensis* might be rediscovered. However, there is little information regarding its habitat or elevation. Hose (1927, 1929) did not describe the habitat in which his specimens were taken, although it may reasonably be assumed that they were acquired in primary forest, which is the preferred habitat of *R. longirostris* (Eaton *et al*. 2021). Everett's Kinabalu specimens bear no elevation data. On Mt. Dulit, Hose procured specimens at 3,000–4,000 ft. (*c*.900–1,200 m), and the bird now suspected to be from Murud Kecil was collected at 4,000 ft. (*c*.1,200 m). While these elevation data may not be especially accurate, a proposed range of 900–1,200 m is similar to that of other regional specialities such as Dulit Frogmouth *Batrachostomus harterti* and Black Oriole *Oriolus hosii*, although both have since been found higher or lower and neither occurs north to Sabah (Mann 2008, Eaton *et al*. 2021, MNS Bird Conservation Council 2021). Both were also 'lost' for several decades in the 20th century due to a lack of field work in Sarawak (Mann 2008).

Assuming a distribution that extends over most of the Central Highlands, a total of *c*.65,000 km^2 of forest lies between 900 and 1,200 m (per Global Forest Watch 2022; see Fig. 4), thus a large area in which the species could yet be rediscovered. Forest loss in the species' range has been minimal (*c*.3–4% during 2000–20; per Global Forest Watch 2022), and although logging tracks now crisscross much of Sarawak's highlands (including Mt. Dulit), a continuous area of primary forest at suitable elevations stretches most of the Central Highlands, especially in Kalimantan, where more than 7,000 km^2 remains in Kayan Mentarang National Park alone.

Across Sundaland, camera-trap surveys have proven to be an effective means of studying some Galliformes (e.g., Winarni *et al*. 2005, Dinata *et al*. 2008, O'Brien & Kinnaird 2008, Liang *et al*. 2018). However, the species' sole congener, *R. longirostris*, is extremely elusive, rarely recorded (Boakes *et al*. 2020, eBird 2022) and does not appear to have been documented by any published camera-trap studies. Auditory surveys may therefore prove more successful; however, this depends on the species' vocalisations being described (calls similar to *R. longirostris* in Sarawak's highlands should be followed up). Survey effort across the predicted range should target a range of soil types and microhabitats (gullies, slopes, etc.) to offer the best chance of rediscovery, as might consultation with local people / hunters potentially familiar with the species.

Dulit Partridge is currently listed on the IUCN Red List as Vulnerable C2a(i) (BirdLife International 2022) with justification that the species 'is assumed to have a very small population (perhaps fewer than 2,500 mature individuals, given the paucity of records)

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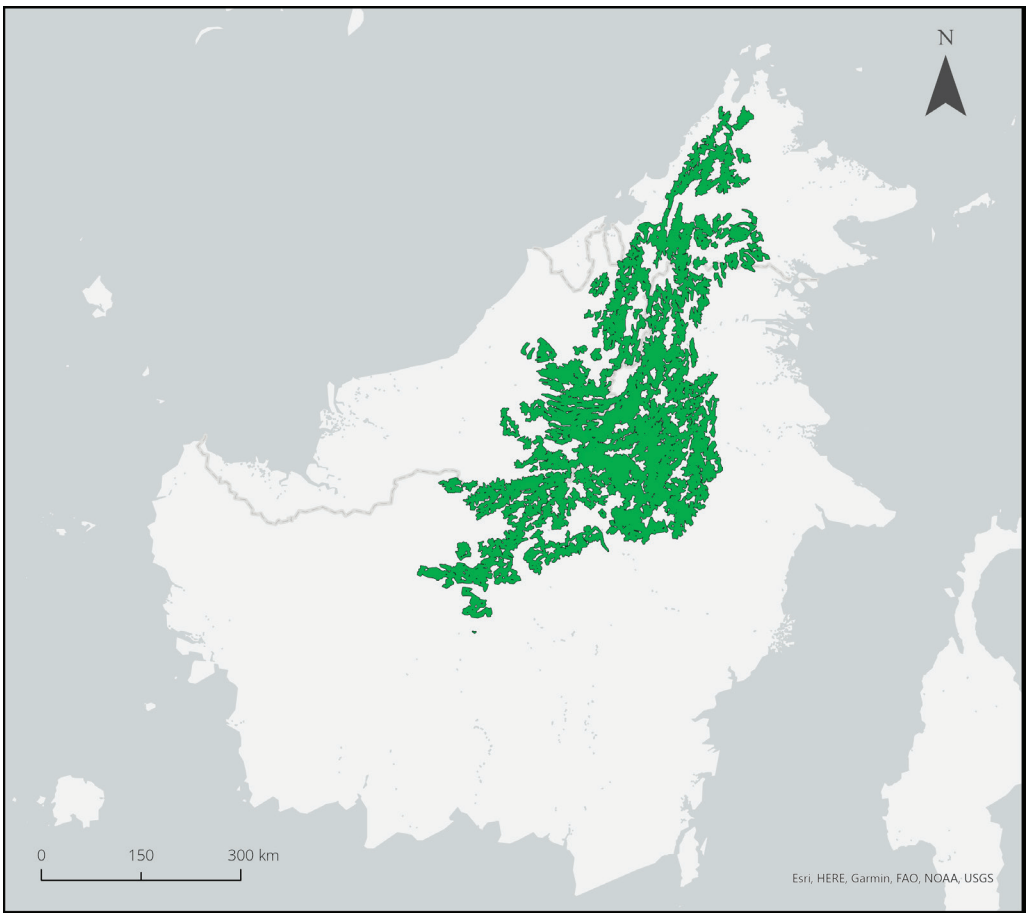

Figure 4. Approximate distribution of primary forest within the apparent elevational range of Dulit Partridge *Rhizothera dulitensis*. Dark green = forest at 900–1,200 m, per Global Forest Watch (2022).

which is inferred to be in decline owing to habitat loss and degradation in some areas, with all subpopulations likely to number fewer than 1,000 mature individuals'. Applying the information available, this is difficult to uphold. There are no data from which to formulate a current population size or trend with any accuracy, and additional uncertainty surrounds the species' distribution. Although the lack of contemporary sightings may suggest the species is threatened, or even extinct, a large area of potentially suitable habitat remains and this species, if like *R. longirostris*, is probably very elusive. Given the litany of uncertainties documented herein, re-assessment as Data Deficient seems appropriate.

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