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Using remote sensing to inform conservation status assessment: Estimates of recent deforestation rates on New Britain and the impacts upon endemic birds

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ABSTRACT

Remote sensing is increasingly used by policy-makers and conservationists to identify conservation priorities and changes in land cover. This is particularly important in the biodiverse tropics, where there are often few field data. Conservation action is often directed towards areas containing globally threatened species, but there have been few attempts to improve assessments of species' extinction risk through remote sensing. Here, in a novel approach we use deforestation estimates, measured through satellite imagery, to assess the conservation status of an entire endemic avifauna, based on IUCN Red List criteria. The island of New Britain, east of New Guinea, is of very high global conservation importance, and home to 37 endemic or restricted-range bird species. Analysis suggests 12% of forest cover was lost between 1989 and 2000, including over 20% of forest under 100 m altitude, with substantial areas cleared for commercial oil palm plantations. Application of the IUCN Red List criteria to these new data on area of remaining forest and rates of deforestation indicates that many species are more threatened than previously realised, with the total number of threatened or near threatened species increasing from 12 to 21. Thus, this study highlights the urgency of establishing and effectively managing protected areas in suitable lowland forests of New Britain. More broadly, it demonstrates another potential of remote sensing to assist strategic conservation decisions.

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1. Introduction

Globally, deforestation is among the largest threats to biodiversity (Pimm et al., 1995; Baillie et al., 2004), and habitat loss and degradation, driven primarily by deforestation, is the most important threat to the world's birds (BirdLife International, 2004a). Remote sensing, using earth observation satellites, is increasingly used to map land cover (e.g. Achard et al., 2002; Mayaux et al., 2005), permitting a rapid assessment across areas that may be too extensive or too difficult to survey on the ground. By comparing images from two dates, it is possible to quantify the extent of deforestation (e.g. Skole and Tucker, 1993; Steininger et al., 2001; Harper et al., in press).

New Britain (c. 5°30′ S, 151°30′ E, 35,000 km^2) is an island situated off the east coast of New Guinea. It is under serious threat from deforestation (Swartzendruber, 1993; Stattersfield et al., 1998), with its lowland forest most susceptible to clearance for timber and conversion to small-scale agriculture and larger-scale commercial coconut and oil palm plantations (Swartzendruber, 1993). Although this is true of much of South-East Asia (e.g. Lambert and Collar, 2002; Curran et al., 2004) and Melanesia, New Britain has been particularly severely affected. Government forest allocation plans and logging concession boundaries show that all lowland forest in West New Britain, and nearly all in East New Britain, is allocated to industrial logging (Shearman and Cannon, 2002; Brown and Jacobson, 2005). Indeed, West New Britain province alone continues to account for at least 50% of Papua New Guinea's timber exports (Bun et al., 2004).

New Britain is of global importance for biodiversity. It forms part of a high priority Endemic Bird Area (EBA) with New Ireland and satellites which together support 38 endemic bird species (Stattersfield et al., 1998) and is further recognised as a global conservation priority by Brooks et al. (2006), its inclusion in the East Melanesian Islands Biodiversity Hotspot (Beehler et al., 2004) and the Global 200 Ecoregions (Olson and Dinerstein, 1998). It supports 37 restricted-range bird species (global range < 50,000 km^2) and a number of other endemic bird taxa such as *Myzomela (eques) cinerascens* that have been proposed as full species (Coates, 1990). Of the restricted-range species, 16 are endemic to New Britain and its satellite islands and a further 14 occur on only New Britain, New Ireland and satellite islands (Stattersfield et al., 1998; Beehler, 2001). Yellow-bibbed fruit-dove (*Ptilinopus solomonensis*), which is endemic to the larger EBA, does not occur on New Britain. Detailed information on the distribution and abundance of many of the endemic species is sparse, with a few exceptions (e.g. Marsden et al., 2001; Marsden and Pilgrim, 2003). Indeed, Beehler (1993) noted a lack of information on any biodiversity from many parts of the island.

Although it is not prescriptive, the IUCN Red List of threatened species (henceforth 'Red List') has become a valuable tool in conservation planning, increasingly helping to focus priorities for conservation funding and action (Rodrigues et al., 2006). However, the paucity of information on New Britain has made it difficult to accurately assess the conservation status of its species using the Red List categories and criteria (IUCN, 2001). The Red List uses five criteria with quantitative thresholds based on rates of population decline (criterion A), range size and decline (B), population size and decline

Table 1 – Summary of IUCN Red List criteria

	Criteria	Critically endangered	Endangered	Vulnerable
Population reduction	A1[a]	⩾90%	⩾70%	⩾50%
	A2–4[b]	⩾80%	⩾50%	⩾30%
Small range	B1: extent of occurrence[c]	<100 km^2	<5000 km^2	<20,000 km^2
	B2: area of occupancy[c]	<10 km^2	<500 km^2	<2000 km^2
Small and declining breeding population	C[d]	<250 mature individuals	<2500 mature individuals	<10,000 mature individuals
Very small breeding population	D1	<50 mature individuals	<250 mature individuals	<1000 mature individuals
Very restricted breeding population	D2[e]	–	–	<20 km^2 or <5 locations
Quantitative assessment	E[f]	⩾50% in 10 years/three generations[g]	⩾20% in 20 years/five generations[g]	⩾10% in 100 years

a Over 10 years/three generations (whichever is greatest) in the past, where the cause is reversible, understood and ceased.
b Over 10 years/three generations (whichever is greatest) in past, future or combination.
c And two of: fragmentation; continuing decline; fluctuation.
d Either continuing decline over specified rates and time periods; or with specified population structure or fluctuation.
e Susceptible to stochastic events or human impacts and therefore capable of becoming critically endangered or extinct within very short time.
f Estimated extinction risk from quantitative models.
g Whichever is greatest.