Protecting Sulawesi's Endangered Biodiversity through REDD: A Case Study in a New Indonesian Province, Gorontalo.

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Sulawesi lies almost at the centre of the Indonesian archipelago (land area 186,145 km^2). It has one of the most distinctive faunas of anywhere in Indonesia: 79 of its 127 indigenous mammal species (62%) are endemic (a percentage which rises to 98% if bats are excluded). Sulawesi is the largest and most central island of Wallacea, the bio-geographical transition zone between the Asian and Australasian fauna first identified by Alfred Russel Wallace in 1869. Gorontalo in northern Sulawesi is one of Indonesia's newest provinces (population 900,000, area 12,000 km^2). It was established in 2001 by the division of North Sulawesi province in two.

The purpose of this paper is to describe a conservation case study over the last 18 years in an Indonesian watershed in Gorontalo Province. This includes implemented reduced emissions from deforestation over a 52,000 hectare Sulawesi rain forest, called Nantu.

The Nantu Forest is a 31,000 hectare wildlife reserve in Gorontalo province. It is today one of Sulawesi's few remaining intact pristine forest ecosystems. It was formally gazetted as a wildlife reserve (suaka margasatwa) in 1999 by the Indonesian government and expanded to 52,000 hectares by local legislation in 2004. It lies in the upper reaches of Gorontalo's second longest river, the Paguyaman (99.9 km in length), 140 kilometres to the west of Gorontalo city ($0^0$46'N $120^0$16'E), and is accessible only by longboat. Our conservation work at this site began in 1989 as an ecological study of the babirusa and has expanded into a watershed conservation programme, conducted in partnership with the local government and wildlife department (SBKSDA Gorontalo).

Nantu is a site of global importance for Sulawesi's endemic, endangered biodiversity. It is the last stronghold on earth of the babirusa, a curly-tusked pig whose wild population numbers less than 5000. It is of international importance for Sulawesi's other unique Wallacean biodiversity, including the anoa, a rare dwarf buffalo, the locally endemic Heck's macaque, the spectral tarsier, Sulawesi wild pig and more than 90 species of birds (35 endemic). Nantu is extraordinary in the existence in the forest of a large natural salt-lick, called Adudu, where Sulawesi's endemic wildlife,

particularly the babirusa and anoa, congregate to consume the mineral rich soil and waters, and where these otherwise rarely observed large mammals can be observed with relative ease.

The babirusa is Sulawesi's most charismatic large mammal, and the flagship species of the Nantu Forest. Its most extraordinary feature is its four amazing tusks, present only in adult males, two upper tusks growing vertically up through the skin of the snout and curving back around towards the forehead (the only mammal in the world whose upper canine teeth are completely reversed), while two other tusks curve out from the lower jaw. The babirusa's extraordinary appearance, the tusks combined with a whitish-gray, hairless, hippo-like body weighing up to 100 kg, has fascinated observers for many centuries and the species was the first Sulawesi mammal to be known in Europe, in 1650. The babirusa is today in grave danger of extinction, due to its limited global range, the loss of its rain forest habitat and its slow reproductive rate (producing one piglet at one time). The babirusa feeds on fruit (for example *Pangium edule, Dillenia serrata, Mangifera,* figs) as well as grasses and some animal material and plays an important role in forest seed dispersal. The babirusa is dependent upon pristine rain forest, requiring mud wallows for heat relief. Observations and information from experienced hunters indicate that once a forest begins to become degraded, the more robust Sulawesi wild pig (*Sus celebensis*) will move into the area, and the babirusa disappear. The Sulawesi wild pig can survive in a wide variety of habitats, from agricultural forest edge to rain forest and is still relatively common (e.g. 30 per week in local market). Endemic to Sulawesi the Sulawesi wild pig is not legally protected and produces 3+ piglets at one time, in contrast to the slowly-reproducing babirusa.

The Adudu salt-lick at Nantu constitutes a gathering point for babirusa groups and up to 40 individuals have been observed together at one time there. It offers the chance to observe the babirusa's extraordinary jousting behaviour, in which adult male babirusa rear up on their hind legs in a symmetrical combat dance. This behaviour is only known in one other suid anywhere in the world (*Sus scrofa cristata* in Sri Langka). Babirusa come to the salt-lick throughout the day and analysis of the lick soil and water has shown them to be rich in minerals, including sodium and calcium, which may supplement the babirusa's diet.

The Nantu forest lies at an altitude of 30 m, with its highest point at 2065 m. It includes natural stands of mature *Eucalyptus deglupta, Dracontomelum dao* and *D. mangiferum, Pangium edule* and *Palaquium* (locally known as Nantu), (and figs, 6 species of palms and rich stands of rattan). The Nantu reserve comprises the entire catchment area of the Nantu river (right branch of the Paguyaman river). Today more than 30,000 villagers living downstream, most small farmers, are dependent on this river for their only water supply.

The chronology of the Paguyaman watershed 1989-2007 illustrates a dramatic case of deforestation, main threats being illegal logging, slash-and-burn clearance, as well as wildlife poaching. In 1989 the entire Paguyaman watershed, left and right branches, upriver from Potangga was completely covered by undisturbed primary rain forest. In 1991 a large sugar cane factory owned by Barito Pacific timber company was established at Lakea and this was a contributing factor to movement of settlers upriver. Our observations indicated that about 40% of the primary forest covering the Paguyaman watershed in 1989 has now been destroyed, particularly the left branch of the Paguyaman river (Figure 1).

The Nantu Nature Reserve remains today an intact pristine forest, one of Sulawesi's few remaining representative rain forest ecosystems, owing to continuous and intensive forest law enforcement efforts there over the last fifteen years. These have taken the form of continuous protection by local police personnel (POLRI) in the form of 4 Brimob personnel present at the remote Nantu field station at all times. These personnel work alongside local assistants patrolling the Nantu Forest daily, in particular the reserve's south-east boundary. Prior to, and at the start of, their deployment, ten rafts of illegal timber per day ($40m^3$) of illegal timber were being extracted from the Nantu watershed (measured by daily records of rafts passing the Nantu field station/guard post). The presence of these patrols has overall been sufficient to deter illegal loggers from operating within the Nantu Reserve, although continued vigilance is needed as today illegal logging is again occurring in Nantu's remote south-east corner. Outside the reserve, however, joint patrols with local wildlife department and police detained 70 m^3 of timber cut in a few days from the left branch of the Paguyaman river in 1998. This low cost, high impact method of protection has also been responsible for preventing destruction of SMS Nantu from slash-and-burn, despite intense pressure. Since the early 90's there has been a sustained wave of forest burning moving up the Paguyaman river (Figure 2). Along the Nantu river, for

example, 1000 ha of primary floodplain forest were burned during the long dry season of 1997 (4 months) by settlers backed by local land speculators.

The left branch of the Paguyaman river was deforested by large scale logging by Barito Pacific Timber group (40,000 ha concession) 1994-1998, followed by groups of settlers coming in along the logging road. Further settlement of this area occurred when a transmigration settlement (200 families) was established there, on the southern boundary of the Nantu wildlife reserve, in 2005.

Destruction of the Adudu salt-lick and Nantu's wildlife populations has also been prevented by the presence of POLRI/Darwin Initiative patrols. The Adudu salt-lick remains well visited by babirusa and other wildlife (estimated population of babirusa at Nantu 500 individuals) although two other salt-licks outside the Nantu Reserve, on the left branch of the Paguyaman, have been destroyed by slash-and-burn. The Adudu lick remains today one of the few places on earth where Sulawesi's extraordinary wildlife can be observed with relative ease.

Our enforcement efforts and protection patrols have also protected the area's wildlife from local extinction by the bushmeat trade. In 1989 hunters were detained with 17 babirusa and 2 anoa, which had been trapped in leg-snares at the Adudu salt-lick. This figure represents a window into northern Sulawesi's bushmeat trade. Around 30 dealers drive out each week from Minahasa (the hinterland of Manado) to the Gorontalo area and around to Central Sulawesi in order to purchase wild meat for sale in the meat markets near Manado. Data from dealers involved in this trade for over 40 years indicates dealers are travelling further and further from Manado in order to purchase wild meat (babirusa, Sulawesi wild pig, bats, macaques [as well as dogs]), reflecting local extinction of these species over an expanding area. One hundred years ago Alfred Russel Wallace observed babirusa 20 km from Manado city; today dealers are driving 600 km to the west of Manado to purchase babirusa. We have conducted monitoring in local meat markets each week over the last ten years on Saturdays, the main weekly market. Our data reveals a total of 1859 babirusa and 16,263 Sulawesi wild pigs were sold in the main meat market of Minahasa, called Langowan, between 1998 and 2007 (Table 1, measured by a local woman posing as a shopper). Records from literature indicate an estimated 1500 Sulawesi wild pigs and 750 babirusa were trapped in one year in 1977/8 from the head of the

Dumoga valley, part of North Sulawesi's Bogani Nani Wartabone National Park.

All meat is transported along the trans-Sulawesi highway. Twice yearly anti-poaching operations conducted between 1990-2002 by authorities and project staff, one prosecution resulting in a jail term for the offender (2002) and extensive awareness work about the wildlife laws have resulted in a decline in babirusa sold in markets of Langowan market from 15 per week in 1991 to 2 per week today. While this may be a reflection of the declining wild population of babirusa information from hunters and dealers suggest it also reflects an increased awareness that penalties for offenders may be implemented.

In 2004 local legislation by Kabupaten Gorontalo was implemented by which the Nantu Nature Reserve was expanded in size, from 31,000 to 52,000 hectares, called the Nantu Boliyohuto conservation forest. This involved the addition to the conservation area of 11,000 hectares of protection forest and 10,000 ha of production forest.

A key feature of the Nantu project has also been a local education programme. Two main villages now border the Nantu Forest: Sari Tani village today has a population of about 300 families, while Pangahu village has about 150 families. (Figure 3). Education initiatives in these villages have included environmental education teaching, creation of a children's story book (5000 copies distributed to local children) called "The Special Place in the Forest" about the Adudu salt-lick, assistance with desks, chairs and writing books, village ecology libraries and children's study visits to the Nantu Forest.

We are currently working to establish the Nantu field station as a biodiversity and climate care education centre, and in July 07 convened a three-day field workshop for 30 local stakeholders on climate change issues and hands on carbon stock measurement, in collaboration with colleagues from ICRAF and Brahwijaya University. Other field trainings for local stakeholders have been held on biodiversity conservation and the Islamic basis for Conservation, incorporating practical wildlife watching. The Nantu field station also has excellent potential as a biodiversity research centre for local and international stakeholders. Much biological research remains to be done on Nantu's fauna and flora, including species such as Heck's macaque, and Sulawesi wild pig, whose ecology is poorly known.

We are also developing participatory boundary protection amongst local communities so that settlers now living along the reserve boundary might each assist in preventing incursions along “their” section of the Nantu boundary.

Current agricultural focus in these villages is on maize planting, while tree-based livelihoods remain scarce. This maize-based farming is not based on sustainable soil management. The Nantu project has provided livelihood assistance to local people living outside the reserve through provision of 20,000 cocoa trees and 8000 teak trees, grown in community nurseries, to settlers for planting as a bufferzone crop on their own land. Species were selected in response to local request.

Initial estimates of carbon stocks at Nantu by local stakeholders and ICRAF scientists suggest this 52,000 hectare forest has about 200 tons of carbon per hectare. Our cost-efficient enforcement patrols have therefore protected a carbon stock at Nantu of approximately 10 million tons. Our direct observations indicate that between 1989-2007, at least 30,000 hectares of primary rain forest in the Paguyaman watershed, but outside the Nantu protected forest, have been destroyed by slash-and-burn clearance and “legal” and illegal logging, with a consequent loss of an estimated 6 million tons of carbon. These patrols have also prevented the poaching of an estimated 500 babirusa, which would without doubt have otherwise been exterminated for the meat trade.

In conclusion, work at Nantu is unusual in representing a multi-sectoral forest protection effort, involving local police, wildlife department and a wide range of other local government institutions. It combines forest law enforcement with strong local support built up through education and awareness programmes. This study, from a new Indonesian province, provides a practical example of grass-roots implementation of REDD which we hope will be of use to other provinces throughout Indonesia.

Finally we would like to thank our many colleagues for their assistance, and particularly Mr. Abdullah Rufii and colleagues at the Ministry of Forestry for giving us the opportunity to speak today, and would like to invite anyone here to visit the Nantu Forest to observe firsthand our activities there.

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Table 1: Number of Babirusa and Sulawesi Wild Pig Observed on Sale at Langowan Market, Minahasa, Sulawesi, 1998-2007#

Year	Total number of Babirusa observed in market	Average number of Babirusa observed per week	Total number of SWP observed in market	Average number of SWP observed per week	Number of weekly surveys during year
1998	237	9	2027	72	28
1999	481	12	2602	65	40
2000	292	8	1708	47	36
2001	292	9	1337	41	33
2002	284	7	1582	40	40
2003	55	2	1414	40	35
2004	32	1	1498	39	38
2005	57	2	1640	42	39
2006	73	2	1460	38	38
2007	56	2	995	40	25
TOTAL	**1859**		**16,263**		

= weekly monitoring by local woman posing as shopper, recorded at 07.00 am each week.

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