5-127

Sustainability of wildlife and rattan trades in North Sulawesi, Indonesia

Final Report to the Darwin Initiative

E.J. Milner-Gulland and Lynn Clayton,
Renewable Resources Assessment Group,
[redacted]

FINAL REPORT TO THE DARWIN INITIATIVE

1 BASIC PROJECT DETAILS

Project title: Sustainability of wildlife and rattan trades in North Sulawesi, Indonesia.

Contractor: Imperial College, London (previously University of Warwick).

Project reference number: 162/5/127

Grant round: 4

Grant value: £118,475 (increased to £122,302 due to cost of living increases).

---

2 PROJECT EXPENDITURE

Total grant expenditure: £124,760

Breakdown of expenditure:

Item	Expenditure (£)				
	1996-7	1997-8	1998-9	1999-00	Total
Rents etc.	[redacted]				
Postage etc.					
Travel & subsistence					
Printing					
Conferences, seminars					
Capital items					
Other					
Salaries					
Total					

Explain any variations +/- 10%:

The salary component for Lynn Clayton was increased with the agreement of the DETR to cover increases in cost of living for 1998-9 and estimated increases for 1999-00. The printing and conference/seminar costs, together with the field assistants' salaries and other costs, were paid for from a grant received from the People's Trust for Endangered Species, which was awarded as a direct result of the Darwin project. This meant that the expenditure profile of the Darwin grant was substantially altered compared to the original agreement. These changes were agreed with the DETR. It will be noticed that the component of the expenditure for Lynn Clayton's salary for 1/4/99 to 30/9/99 has increased from the previously estimated level of [redacted] This is due to a 3.5% cost of living increase, which took her salary to [redacted] increase takes the expenditure on the grant in the 1999-00 period from the agreed [redacted]

3 PROJECT BACKGROUND/RATIONALE

Why was the project needed? Please explain the project development process.

The Biodiversity Action Plan for Indonesia specifically recommends research and action on the wildlife trade. Many threatened and endemic species are traded in North Sulawesi, making it a particular priority area for research and conservation work on traded species. One of the project leaders, Lynn Clayton (LC), had spent the previous five years in the area, working on the conservation of a particularly endangered endemic wild pig species (the babirusa), and had monitored high levels of trade in it and other species. A bio-economic model developed by the project team prior to applying for the grant, and based on data collected by LC, highlighted the importance of controlling the trade for the conservation of these endemic wild pigs. The economics of the rattan trade and the population dynamics of these plants interact in a similar way to those of traded wildlife, because both are taken from the forest along a linear route (a road or river) for sale to middle-men. Rattan is a major source of income for many people, but is being unsustainably harvested; thus it is necessary to quantify the effects of the rattan trade on rattan populations and make recommendations for its sustainable harvest.

How was it related to conservation priorities in the host country?

The Biodiversity Action Plan for Indonesia specifically recommends research and action on the wildlife trade, as was carried out in this project.

How was the project intended to assist the host country to meet its obligations under the Biodiversity Convention?

The project was intended to help Indonesia meet its obligations related particularly to the following Articles of the Biodiversity Convention: Article 8: Manage biological resources important for the conservation of biological diversity within protected areas; Article 10: Adopt measures relating to the use of biological resources to minimise impacts on biological diversity; Article 11: Adopt economically and socially sound measures that act as incentives for the conservation of biological diversity.

Was there a clear "end-user" for the project in the host country? Who?

There were a number of beneficiaries of the project, although none was a clear end-user. The beneficiaries include the citizens of North Sulawesi in general, who have received education on the value of their natural resources and the legal requirements for their conservation, particularly threatened species. Forestry officials, local students and village decision-makers have been trained to teach others of the legal and ecological status of traded species and ways to make the trade more sustainable. Local police forces have been assisted in their law enforcement duties for the conservation of protected species such as the babirusa.

4 PROJECT OBJECTIVES

What were the objectives of the project (as stated in the original application form)?

1) **To raise awareness** among the citizens of North Sulawesi of the value of their natural resources and the legal requirements for their conservation, particularly threatened species.

2) **To train** forestry officials, local students and village decision-makers to teach others of the legal and ecological status of traded species and ways to make the trade more sustainable. Targeting the major local decision-makers to be trained as trainers is the most effective way to transmit the message to others.

3) **To analyse** the magnitude of the offtake and the economics of the trade using models to explore the interactions and make policy recommendations.

4) **To collect data** on the current status and value of populations of the traded species, and train local students and forestry officials in data collection.

5) **To test** scientifically the short- and medium-term effects of conservation policies on offtake rate.

Were the objectives of the project revised? If so, how?

No, they were not.

Have the objectives been achieved? If so, how?

Yes, they have.

1) **To raise awareness** among the citizens of North Sulawesi of the value of their natural resources and the legal requirements for their conservation, particularly threatened species.

This objective was achieved in several different ways:

Public awareness campaigns

Newspaper articles were written describing the work of the project (see attached), and the project was featured on national television. LC visited five villages, at which she presented videos of the threatened wildlife to villagers (the majority of whom were previously unaware of the legally-protected status of these species). The project also distributed T-shirts and stickers displaying the project logo (a sample of each was sent to the DETR previously - see the front cover of this report for the logo design). Two permanent illustrated displays describing the wildlife laws were erected at strategic points, one at Langowan market, the other at a key junction along the trans-Sulawesi highway. As well as targetting the general public, our awareness campaigns also targetted key decision-makers at the local, provincial and national levels. Video presentations were given to these individuals and their staff, who included two consecutive Ministers of Forestry, two consecutive Director Generals of the Indonesian Wildlife Department, the local regional head and local forestry department head. Copies of the wildlife laws covering protected species were distributed to all local police

offices in Bolong Mongondow district and are being distributed to police offices in the remaining two districts of North Sulawesi province.

Law enforcement

Public awareness of the trade in protected species and the importance of protecting forest habitats for all traded species (including rattans) was also heightened by the high profile arrests and subsequent action, including court cases, taken against law breakers. This was carried out by local officials, but with the support (in terms of information, expertise, manpower and finance) of our project. Such prosecutions are extremely rare in North Sulawesi; the cases we supported were amongst the first in the province. The law breakers included wild pig traders and illegal loggers.

2) **To train** forestry officials, local students and village decision-makers to teach others of the legal and ecological status of traded species and ways to make the trade more sustainable.

Training was carried out for the following groups:

- Six former wild pig hunters were retrained as field assistants, carrying out duties including ecological surveys of wildlife and rattan populations, and the guarding of key habitats for endangered wildlife. The fact that these former hunters were now guarding endangered species had an impact not only on their attitudes, but those of their villages and families, including other hunters.

- A total of 15 Forestry Department officials took part in four intensive wildlife habitat protection operations, each lasting one week. A further 30 forest guards received on the ground training in conducting checkpoints, while 8 government forest guards received on the ground training in reserve management and protection at the Paguyaman Forest.

- Presentations about the project and the scientific issues which it addressed were given to students studying conservation at Bogor Agricultural University and to scientific colleagues at the Indonesian Institute of Sciences. Two Indonesian colleagues, one of which is studying for a PhD, the other of whom is applying to study for a PhD, were closely involved with our project, receiving training in research methods through field visits to our study sites. These were Mr. Abdul Haris Mustari (wildlife conservation) and Mr Agung P. Sarjono (rattan transects).

3) **To analyse** the magnitude of the offtake and the economics of the trade using models to explore the interactions and make policy recommendations.

This objective was achieved (see scientific description below).

4) **To collect data** on the current status and value of populations of the traded species, and train local students and forestry officials in data collection.

This objective was achieved (see scientific description below). The training element is discussed above, with respect to objective 2.

5) To test scientifically the short- and medium-term effects of conservation policies on offtake rate.

This objective was achieved (see scientific description below).

---

5 PROJECT OUTPUTS

Which output targets, if any, were specified for the project? Have they been achieved? If relevant, what outputs were not achieved, or only partially achieved, and why?

The list below details the outputs which were specified for the project, in chronological order as in the work programme. The way in which they were achieved is also discussed.

Ref. #	Details	Comments
14	One 2-3 day UK workshop held for UK personnel	This was held before LC left for Indonesia, in order to clarify project aims and methodologies.
5	6 field assistants and 20 students trained in survey work.	6 field assistants were employed by the project, and were trained in ecological survey work, both for mammals and for rattans. A market monitor was trained in market surveys of wildlife sales.
6	10 MPI employees trained for 2 weeks in trade monitoring & law enforcement	In discussion with managers at MPI, it was decided that a better strategy would be to train 2 employees intensively, rather than to train more people in less depth. This was agreed with the DETR.
14	1 day workshop held in Indonesia to examine survey results and refine monitoring techniques.	The was carried out during a one month visit to Sulawesi by EJMG
5	6 field assistants trained for one week in conservation communication	The field assistants were given on-the-job training in conservation communication, and accompanied LC on publicity visits to villages and local decision-makers.
6	50 rattan collectors trained for 1 week in financial planning, 3 rattan cooperatives formed	We developed excellent relations with rattan factory owners, and it was decided that project objectives would best be served by working directly with them, rather than with the rattan collectors. This was agreed with the DETR.
15, 16, 17, 18	Publicity material produced - 1 video, 100 T-shirts, 500 stickers, 500 leaflets, 10 banners, visits to schools, TV and radio features	This material was produced, apart from the leaflets and banners, which will be produced in early 2000. The DETR have been supplied with samples of the T-shirt and stickers. 6 videos were produced, 3 of which have been shown to DETR staff. The visits and interviews are described above.
14	One day workshop held in Indonesia for feedback from the project	A number of presentations and discussions were held with local & national stake-holders, to give feedback from the project (see above). Feedback

		within the project was obtained from a 1 month visit by EJMG to the project and constant e-mail contact between the team members.
14	Two-three day workshop held in the UK	This was done when LC visited the UK for one month; all those involved in the project attended meetings to discuss project progress.
	Model developed & implemented	This was carried out (see scientific description below).
	40 ecological surveys were carried out to establish population estimates for the species surveyed	Surveys were carried out in 3 locations in the Paguyaman watershed. Transects were cut and walked totalling 5 km in length (10m width); every rattan plant along these transects was described. It was decided to concentrate on carrying out thorough surveys of a few locations rather than less detailed surveys of many locations, to provide more useful data for the sustainability assessments.
14	One day workshop held in Indonesia to gain impressions of policy effectiveness & implementation	A within-project meeting was held during the time that EJMG was visiting the project. Meetings to assess policy effectiveness & implementation were also held with local and national forestry officials.
14	Two-three day workshop held in the UK	Lynn Clayton returned to the UK for one month each year; during these periods, several workshops were held for the assessment of project progress.
14	1 day workshop held in Indonesia to examine the early monitoring	The workshop was held with forestry officials in Manado, the provincial capital. This was attended by the Director of Conservation for the North Sulawesi Forestry office and his staff.
	20 ecological surveys carried out	See comments above concerning ecological surveys; fewer were carried out, but they were more thorough then anticipated.
14	1 day workshop held in Indonesia for discussion of data	Project findings/data were reported to key decision makers in Jakarta in November 1999 during three-days of meetings.
14	2-3 day workshop held in the UK	This will be held in the next few weeks, while LC visits the UK.
	30 copies of publicity material distributed	This is currently being prepared.
	Final report completed and presented to the Indonesian Government & other organisations	This is currently being prepared. The Indonesian Institute of Science and the Ministry of Forestry received quarterly reports on project progress and copies of scientific articles. Other organisations, such as the World Bank Environment Department and the Wildlife Conservation Society, have also received regular progress reports and copies of scientific articles throughout the project.

Were any additional outputs achieved?

Ref #	Description
2	One UK MSc student, T Evans, at Warwick University. Masters thesis "Forest mapping in North Sulawesi, Indonesia".
6	15 Forestry Department officials trained during 4 1 week intensive wildlife habitat protection operations. 30 forest guards trained in conducting checkpoints. 8 government forest guards trained in reserve management and protection at the Paguyaman Forest. 2 Indonesian graduates trained in research methods.
7?	2 permanent display boards erected, explaining wildlife laws. Copies of wildlife laws given to all police stations in Bolong Mongondow district.
8	LC - 144 weeks, EJMG - 4 weeks. Total = 148 weeks.
11A	2 papers accepted/published (at least 2 further papers are in preparation): Clayton, L.M., Milner-Gulland, E.J., Sinaga, D.W., Mustari, A.H. (in press) Effects of a proposed *ex situ* conservation programme on *in situ* conservation of the babirusa. *Conservation Biology.* Keeling, M., Milner-Gulland, E.J., Clayton, L. (1999) Spatial dynamics of two harvested wild pig populations. *Natural Resource Modeling*, **12**, 147-169.
11B	2 book chapters accepted: Clayton, L., Milner-Gulland, E.J., Sarjono, A.P. (in press) Sustainability of rattan harvesting in North Sulawesi, Indonesia. *Darwin Manual of Plant Conservation in the Tropics.* Royal Botanic Gardens, Kew, UK. Clayton, L., Milner-Gulland, E.J. (in press) The trade in wildlife in North Sulawesi, Indonesia. In: *Hunting for sustainability in tropical forests.* ed. J.R. Robinson & E.L. Bennett. Columbia University Press.
14C	LC presented Darwin project results to Dr Muslimin Nasution (Minister of Forestry); the Flora & Fauna Conservation Programme of the Indonesian Wildlife Department, Jakarta; Centre for Research & Development in Biology, Bogor Agricultural University (Department of Resources Conservation), Indonesian Institute of Sciences, Bogor; members of the Environment Department of the World Bank; and the Director General of the Indonesian Wildlife Department, Jakarta.
14D	Darwin project work has been disseminated in presentations to: University of Oxford (Department of Zoology); Institute of Zoology, Zoological Society of London; University of Leicester (Department of Biology); University of York (Environment Department); Imperial College, Silwood Park (Centre for Population Biology); Imperial College, London (T.H. Huxley School); University of Cambridge (Department of Zoology); the 1999 Darwin Seminar; People's Trust for Endangered Species; Royal Geographical Society; DETR; Flora & Fauna International.
15A	Project featured on Indonesian national TV, being explained by the Head of Forestry for North Sulawesi.
15D	Article in local newspaper, Coventry Evening Telegraph. Articles in newsletters of Warwick University & Oxford University.
17B	Website established at http://www.huxley.ic.ac.uk/research/rrag/rattan.htm
18B	Project featured in one-hour French TV documentary on the biodiversity of Indonesia, shown in France in June 1999 and subsequently in Switzerland and elsewhere, including the National Geographic TV channel. (a copy has been sent to

	the DETR).
22	One rain forest Nature Reserve of [redacted] hectares (Paguyaman Forest) has been formally gazetted as a direct result of the Darwin Project.
23	Resources raised from other sources include: People's Trust for Endangered Species [redacted] the Whitley Award Scheme for International Nature Conservation [redacted] British Airways Assisting Conservation [redacted] as an airfare to Sulawesi); William Edwards Educational Charity [redacted] as a student bursary for forest mapping); staff time from Manado and Gorontalo district Forestry Departments [redacted] staff time of army personnel for habitat protection [redacted] staff time of forest guards [redacted] provision of rooms for meetings by local Forestry Department; funding of Mr Agung P. Sarjono's flights and costs by the Indonesian Forestry Society during his work with our project. In addition, the People's Trust for Endangered Species has pledged a minimum of [redacted] towards continuation of the project's work after completion of the Darwin project.

6 PROJECT OPERATION/MANAGEMENT

Scientific work undertaken, methodology adopted, staff employed, research findings, peer review.

Scientific work was undertaken in the following areas:

- **Surveys of rattan community ecology.**

Methodology

Three transects were established using a sighting compass and measuring tape, running north from the Paguyaman river. Each transect was 10 metres wide and of variable length. The transect was divided into ten-metre long sections. Flagging tape was used to mark and number each ten-metre length of the transect, as well as the transect boundaries. Every rattan plant along the transect was examined and described. Two teams carried out this work, one team of four people cutting, measuring and marking the transect and the second team (two people) examining and describing each rattan plant. Both transect establishment and rattan recording were time-consuming work and were hampered by the mountainous terrain: 300-500 metres of transect could be established in one day (depending on weather and terrain), while every rattan plant along 150-200 metres of transect could be described in a day. Progress was considerably quicker (400-500 m/day) when only plants with mature stems were described, as against every rattan plant. Altitude, slope, light availability and aspect were recorded at every ten-metre point along the transects (using altimeter, clinometer, light-meter and compass) and a soil sample was collected for analysis from each transect location.

A key issue in the project was identification of the rattan species under investigation. The taxonomy of Sulawesi's rattans is very poorly known yet a sound taxonomic base is essential for a scientifically repeatable study, with uncritical use of local names causing considerable confusion. In this study we used local collectors' names are a first step to distinguishing species, but made extensive herbarium collections of each type including fruiting and

flowering material for future taxonomic identification, following the methods of Dransfield (1986). Table 1 shows the rattan types investigated, with species names where known. An advantage of continuing to use local names alongside true species identifications is that the interactions between collectors and rattans are based on the types that they identify. If a type contains species that are significantly different in their biology, then similar harvesting pressure may vary significantly in its effects on the species' population dynamics.

Staff employed

As well as the UK project team (EJM-G, LC), the following staff were involved: Bart Wowor (transect measurement/establishment), James Komolontang (rattan identification), Youtje Mamahit (transect cutting and establishment), Eman Pohulihe (transect cutting, herbarium collections, obtaining information from local rattan collectors), Aji Damai (obtaining information from local rattan collectors) and Meki Mamahit (general field assistance). Short term assistance was also received from many experienced rattan collectors.

Research findings

The main feature of the rattan communities found on the ecological transects was their diversity, both within and between transects (Table 1). Differences in composition of the rattan community between sites are likely to be due primarily to habitat differences. In a comparison of two of the transects, Masina had 18 types of rattan with a density of 47.8 plants/100m^2, while Adudu had 13 types with a density of 57.1 plants/100m^2. Each site had one dominant rattan type, one or two common types, and several less common rattans, although the tail of uncommon rattans was longer at Masina. The dominant types were different in each case.

There were clear differences in growth form between rattan types: Beluo (*Korthalsia celebica* - the only member of its genus occurring in Sulawesi) in particular stands out as having a very different growth form than the others, with more stems, and more mature stems, per plant. This may be explained by the fact that, in contrast to most other rattans, this species exhibits hapaxanthic flowering behaviour (individual stems flowering only once before dying and being replaced by sucker shoots from the base). This species is of no commercial value, mature stems being fine and spindly (3-5 mm diameter). Although the solitary rattans (Tohiti, Topalo) are clearly distinguished by having one stem per plant, they are like the majority of rattan types in their maturity distribution, with many juvenile stems and few mature stems. Although Buku tinggi is similar to the majority of rattan types in the number of stems it produces and their maturity, it is unusual in producing a significant proportion of its new plants through stolons (trailing stems above ground capable of producing roots and shoots at their nodes). The stolons observed were up to two metres in length. The plants that had produced stolons are significantly larger and more mature than those had not done so.

The Masina transect covered two mountains; the first from transect points -500m to 0m with a peak at -370m, the second from transect points 0m to 1500m with a peak at 800m. Inspection of the distribution of rattans along the transect suggests that there is a strong influence of topography on location of rattan types. There is also evidence of different types clustering together; the abundances of Susu, Batang merah and Tohiti are positively correlated with each other, and negatively correlated (separately) with Buku tinggi and Topalo. These correlations could be simply products of similar habitat requirements, or indicate inter-specific interactions between the rattan types. Within a particular rattan type, the distribution of individuals

Table 1 The rattan types found in each of the transect sites, with possible species attributions and information on growth form (clumped or solitary) and commercial importance. Each row is a separate rattan type as recognised by collectors, with clear morphological differences from the other types. The Sold column shows whether it is commercially important; a star in this column indicates that the type was found during the inspections of rattan collectors' rafts.

Local name	Latin name	Adudu	Marisa	Masina	Growth	Sold?
Batang biasa	*Calamus zollingeri?*	Yes	Yes	Yes	Clumped	Yes*
Batang merah		No	Yes	Yes	Clumped	Yes
Susu	*Daemonorops robusta?*	Yes	Yes	Yes	Clumped	No
Tohiti biasa		Yes	Yes	Yes	Solitary	Yes*
Tohiti bubanger		No	No	Yes	Solitary	Yes
Tohiti tunas		No?	Yes	Yes	Solitary	Minor
Topalo		Yes	No	Yes	Solitary	Minor
Topalo tunas		-	No	Yes	Solitary?	Minor
Umbul	*Calamus symphysipus?*	Yes	Yes	Yes	Solitary	Yes*
Umbul tidak coklat		?	No	Yes	Solitary?	?
Beluo	*Korthalsia celebica*	Yes	Yes	Yes	Clumped	No
Ronti		Yes	Yes	Yes	Clumped	Minor*
Malie		Yes	Yes	Yes	Clumped	No
Buku tinggi		Yes	Yes	Yes	Clumped	Yes
Polioto		Yes	No	Yes	Solitary	No
Bukan Susu		Yes	Yes	No	Clumped?	No
Dia lagi		No	Yes	No	Clumped?	No
Topeto		No	Yes	No	?	?*
Tarumpun		No	No	Yes	Solitary	Minor
Tarumpun daun gros		No	No	Yes	Clumped	Minor
Tarumpun daun gros bertunas		No	No	Yes	?	Minor
Tarumpun daun halus/Tohiti halus		No	No	Yes	Solitary	Minor
Tarumpun tunggal (=Tohiti topalo?)		No	No	Yes	Solitary	Minor
Huwulungo		No	No	Yes	Solitary	Minor

through the transect may provide an indication of reproductive behaviour (distance of seed dispersal, degree of reliance on vegetative propagation). If plant distribution was entirely random, then the number of individuals recorded at a particular location would be well described by a Poisson distribution. Deviations from the Poisson distribution might indicate a degree of clumping behaviour by the plants. Indeed, all the types tested (those with at least 20 plants in the sample) showed significant deviation from the Poisson distribution, with more locations having no plants and more having many plants than would be expected if they were distributed at random.

For more detail on the research findings, please see the attached manuscript, "Sustainability of the rattan trade in North Sulawesi, Indonesia".

Peer review

Preliminary results of the work will be published in the Darwin Manual of Plant Conservation in the Tropics, produced by the Royal Botanic Gardens, Kew. Papers for peer-reviewed journals are now in preparation.

- **Surveys of the rattan trade.**

Methodology

Data on offtake rates of rattan were collected by observing the number of rafts passing a particular location on the Nantu river (the right branch of the Paguyaman river). The data were collected every day by field assistants resident at the Adudu base camp on the Nantu river. This camp is located on the river bank; all rafts from upstream must pass this point and are clearly visible from the camp, making recording of numbers of passing rafts straightforward. A sample of rafts was stopped near the base camp and examined to give information on the type and quality of the rattans being collected, as well as on the average number of canes per raft. Collectors were asked where they had been collecting, how long they had been in the forest for, and how many people were in their group. Each cane was examined and its diameter measured using a collector's ruler. A problem with this method is that rafts are composed of bare canes and these can only be readily identified to local names. The number of rafts observed each day over the study period was combined with the information from the sampled rafts on the number and type of canes per raft to give an estimate of the offtake rate. This enables us to estimate the total amount of rattan of each type being harvested from the forest of the Paguyaman watershed upstream of the sampling location during the study period. The information on the location of the harvest was collected to allow us to investigate spatial differences in harvest pressure, in the types of rattan growing in each area and in collector selectivity, when combined with ecological surveys of the same areas. The data on the time spent in the forest by each group of collectors were collected in order to estimate the costs of rattan collection.

Data collected on industry structure & profitability included the costs and prices for rattan collectors. The supply structure in the rattan trade, from collector to rattan company, was also investigated, including prices at every stage, to show how profits are distributed and how possible efficiency improvements, such as through capital provision, might be achieved. Information was gathered during informal interviews and discussions with experienced collectors acquainted with the authors for almost ten years. Companies in Gorontalo, the main rattan processing town in North Sulawesi, were contacted to investigate amounts of rattan

handled there and to gain a wider perspective on the province's rattan trade. Company owners were interviewed and asked about the problems they perceive their industry to be facing and the reasons for these. Data on volume of rattan traded were obtained from one of these companies, as well as from official government statistics. Data on general economic indicators, such as inflation rates, were also provided by the Central Statistical Board of North Sulawesi.

Staff employed

As well as the UK project team (EJM-G, LC), the following staff were involved: James Komolontang (rattan identification, raft counts), Eman Pohulihe and Aji Damai (local rattan collection information, raft counts) and Meki Mamahit (general field assistance). Short term assistance was received from many other experienced rattan collectors providing information.

Research findings

58 rafts were inspected for their contents between 18th and 25th September 1997, belonging to 8 different groups of rattan collectors, each of which had come from a different collection location. The rafts were made up of an average of 155 canes each, and the predominant rattan type was Batang biasa. This is the type that was discovered to have been most heavily harvested at Adudu, suggesting it is an important type for rattan collectors in the Paguyaman watershed. The number of rattan collectors and rafts passing the Adudu field station showed a steep decline from the start of observations in August 1997, stabilising at a low level from June to September 1998, and rising again thereafter (Fig 1). This may be connected with the economic crisis in Indonesia; our observations of the people passing the field station suggested that many rattan collectors had turned to gold panning in this period, because of an increase in the value of gold. This suggestion is supported by interviews with collectors passing the camp. A comparison of the monthly change in inflation rate over the study period against the number of rattan rafts passing the camp suggests that there is a relationship between the state of the general economy and rattan collection; further analysis comparing changes in rattan and gold prices directly is required. However, our data on the offtake of rattan show how strongly linked to the general economy rattan collection is, and will enable us to estimate the profitability of rattan collection and thus predict future offtake levels.

Data obtained from one major rattan company in Gorontalo indicated that 5,907 tonnes of rattan left this company between January 1995 and December 1996, for transport to furniture factories in Java. This rattan was obtained from locations throughout North Sulawesi. 1,545 tonnes of this (26%) was collected at Paguyaman. A breakdown of this volume by trade names indicates that 50.8% of this volume was Batang, while Umbul comprised 27.5% and Tohiti 1%. Further analysis of company records covering volume traded, described by location and trade names, will give a province-wide picture of rattan purchases by this company.

For more detail on the research findings, please see the attached manuscript, "Sustainability of the rattan trade in North Sulawesi, Indonesia".

Peer review

Preliminary results of the work will be published in the Darwin Manual of Plant Conservation in the Tropics, produced by the Royal Botanic Gardens, Kew. Papers for peer-reviewed journals are now in preparation.

- **Market surveys of the wildlife trade.**

Methodology

A local woman who shops at Langowan was employed as a market monitor. The fact that she aroused no suspicion when enquiring about the prices of wildlife products meant that our data on wildlife products on sale in the market were reliable. The monitor visited Langowan market three times each month at 7am and counted the numbers of products on sale there, as well as asking their price. In some cases she bought products, allowing a comparison to be made between quoted and actual prices; there was no systematic difference. Because Langowan was by far the most important market for wildlife, particularly for wild pigs, she concentrated her efforts there. However, on one Saturday each month she visited other markets in the region where wildlife products are known to be sold, to check that there had been no change in their importance as wildlife markets. Saturday was chosen because it is the busiest market day, and the one with the most wildlife products on sale; occasional visits to the markets on other days confirmed this to be the case.

Staff employed

As well as the UK project staff (EJM-G, LC), a market monitor (Henny Pangemanan) was employed to carry out the survey work.

Research findings

All meat products

It is important when researching the trade in wildlife products to have an understanding of consumer preference for and supply of all meats that could potentially be substitute goods for wildlife products, not just of a particular product itself. Table 2 gives an overview of the real prices and quantities of all meat products on sale in the markets of Minahasa. The quantities and real prices of wildlife and wild-caught fish on sale in the markets are much more variable than those of farmed meat like pork and beef. There is a clear influence of Christmas on prices and quantities supplied (and a smaller one of the harvest festival) for many meats, particularly those whose supply can be planned (such as pork and beef). In many cases the quantity supplied is higher at Christmas, sometimes the price is too. The overall time trend in prices and quantities supplied varies between products, but real prices tended to be higher in 1999 than 1998.

Wild pigs

Sulawesi Wild Pigs and babirusas are traded together by wild meat dealers. Their prices are comparable, however babirusas are protected, and thus illegal to trade, unlike Sulawesi Wild Pigs. Much of the conservation effort of the Darwin project was aimed at controlling the trade in babirusas in order to curtail the rapid loss of babirusas in North Sulawesi. Our market monitoring allowed us to assess the effects of our law enforcement efforts on the trade in babirusas, without itself influencing dealer behaviour.

Market data exist for the wild pig trade from 1993-95 and 1997-99. In comparison to 1993-5, there was significantly less babirusa meat on sale in 1997-9, both actually and as a proportion of the total number of wild pigs on sale, but there was no significant change in the total number of wild pigs on sale. There has also been a significant increase in the real price of wild pigs between the two periods. The proportion of babirusa on sale is clearly influenced by law

enforcement (Fig 2), but since June 1998 it has stabilised at around 14% of total wild pig sales (ignoring episodes of law enforcement). By comparison, from early 1993 up to mid 1997, the "base" proportion of the wild pig meat trade that was babirusas was around 38%. This new base level may be due to a change in perceptions among consumers or dealers, or a change in the availability of babirusa. However, it is not a trend but a shift, suggesting perceptions may be more important than supply constraints. This suggests that our project's publicity and law enforcement programmes did have the desired effect of reducing the supply of babirusa meat to the market.

For more detail on the research findings, please see the attached manuscript, "Trade in wildlife in North Sulawesi, Indonesia".

Peer review

Preliminary results were subject to peer review before acceptance as a chapter in the forthcoming book "Hunting for sustainability in tropical forests", edited by J.G. Robinson & E.L. Bennett (Columbia University Press). More detailed results are now being written up for submission to a peer-reviewed journal.

- **Study of the incentives facing a case study wild pig dealer and his hunters**

Methodology

A wild pig dealer (dealer X) who kept very detailed records of all his business transactions offered to let us take copies of his accounts. This was particularly valuable because the dealer had been in the trade for a very long time, allowing us to track changes in the trade in wild pigs over a 10 year period. Although the use of his accounts as a case study involved the assumption that he was relatively representative of the trade as a whole, the trade is becoming more competitive, meaning that any substantial variation between dealers in prices would not be possible. Our project team's good relations with wild pig dealers in general allowed us to assess how representative dealer X was of the profession as a whole; we observed that he was not unusual in his activities. In conservation terms, it was also important to develop good relations with dealers and hunters in order to transmit most effectively the message that trading in babirusas was unacceptable; ceasing this trade would not threaten the dealers' livelihoods, because other commodities that they trade (such as Sulawesi Wild Pigs and domestic dogs) are legal.

Staff employed

UK project staff (EJM-G, LC). The case study dealer provided his detailed accounts, and he and other dealers discussed their incentives and the structure of the wild pig trade.

Research findings

The data from the case study dealer are for both Sulawesi Wild Pigs and babirusas together; it is not possible to distinguish between the two because trading in babirusas is illegal, and the dealer could not give us details of any illegal activity. However, the market data suggest that the prices paid are much the same for the two species. The real price paid at the forest by dealer X increased relative to the real price paid by consumers at Langowan market between the two periods for which data are available both for the market and the dealer: 1993-4 and the last 6 months of 1997. Within the 2 periods, prices were relatively stable. The real price rise between the 2 periods was 31% in the market (Langowan) and 152% at the forest. The price

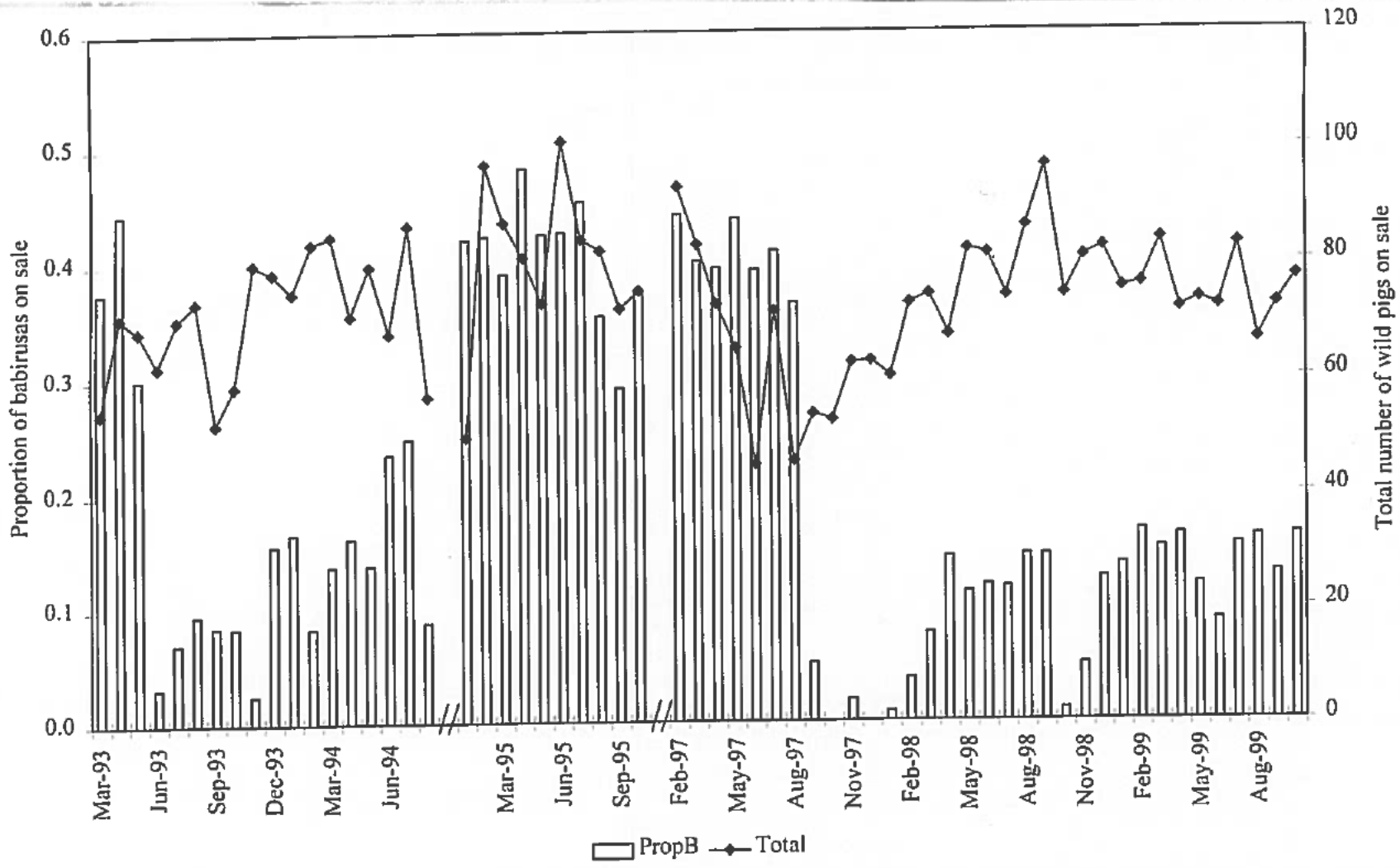

Figure 2 The total number of wild pigs (babirusas + Sulawesi Wild Pigs) on sale in Langowan market, 1993-9 and babirusas as a proportion of the total (PropB). Note the gaps in data collection in late 1994 and late 1995-early 1997. In May 1993, inspectors visited the market for the first time checking for illegal babirusa meat on sale; note the sharp and relatively long-lived drop in the proportion of babirusas on sale. The Darwin project team arrived in early 1997; in September 1997, presentations by the project team to the Minister for Forestry caused him to become personally interested in the plight of the babirusa, with a consequent dramatic drop in babirusa sales; the proportion on sale has not regained its former high level since then. Another market inspection took place in September 1998, again initiated by the Darwin project.

paid per pig by the dealer to his hunters was 12% of the price at Langowan in 1993-4, and 24% in 1997. Dealer X's revenues fell by 36% between the two periods, but the revenues of an average hunter rose by 70%.

Data were available on all transactions made by dealer X in 3 time-periods; April-December 1988, December 1991-June 1994 and June-December 1997. Between the 3 periods there is a clear decline in the number of pigs supplied per hunter, and an increase in the real price paid to hunters per pig and in the variance of that price. Table 3 shows all the variables that are significantly different between the periods. There is a significant increase over time in the mean time that dealer X drives per pig traded (i.e. the time to each pick-up point weighted by the number of pigs bought there). This is true both over the whole period and within the 1991-94 period. The slopes of the 1991-94 and whole period regressions are not significantly different. The mean time driven increases from 563 mins (one-way journey) in April 1988 to 734 mins in Dec 1997. This result bears out anecdotal observations that wild pigs have disappeared from locations nearest to the markets, and that dealers are now travelling further to buy pigs, suggesting a wave of depletion of areas containing wild pigs emanating from the market towns. However, within a given location, there is no effect of date on the number of pigs caught, so that the evidence for depletion is not straightforward. This lack of evidence for depletion may be because of changes in hunting behaviour when pigs start to become scarce in a location. Hunters say that when catch starts to drop off in a place, they first lay more snares in the location, then they shift locations within the area, then they move area. Given this sequence, it is possible that the data would give no suggestion that catch is decreasing for hunters other than the indirect evidence that the dealer's travel times are increasing.

Table 3 Changes in the case study dealer's transactions between three periods; 1988, 1991-4 and 1997. All the data are per trip (the dealer makes one trip per week to purchase wild pigs at the forest edge, and then returns to sell these pigs in the market). All prices are real prices, deflated to January 1988. The figures are averages over all trips within each period, and all are significantly different between the periods (ANOVA test, $P < 0.001$).

	1988	**1991-4**	**1997**
Total # of pigs bought	56	27	17
# of hunters bought from	15	11	9
# of pigs bought/hunter	3.8	2.4	1.8
Total expenditure on wild pigs	392,102	192,138	226,516
Price per pig	7,051	7,189	13,740
Pay per hunter	26,996	16,982	24,478

It is important to realise that there are two processes going on in the wild pig trade - the depletion of the resource and the increase in the competition between dealers as the number of dealers expands. The number of hunters seems to be expanding more slowly than the number of dealers. Thus depletion leads to an increase in travel time, while competition for hunters leads to an increase in the real price paid per pig to hunters. Thus the observed increase in the real price of a wild pig is likely to be related more to competition than to depletion. However, depletion of babirusas is likely to be hidden by the relative resilience of the Sulawesi Wild Pig to exploitation (see modelling results).

For more detail on the research findings, please see the attached manuscript, "Trade in wildlife in North Sulawesi, Indonesia".

Peer review

Preliminary results were subject to peer review before acceptance as a chapter in the forthcoming book "Hunting for sustainability in tropical forests", edited by J.G. Robinson & E.L. Bennett (Columbia University Press). More detailed results are now being written up for submission to a peer-reviewed journal.

- **Effects of conservation policies on the offtake rate of wildlife in the short and medium terms.**

Methodology

The effects of conservation policies on offtakes were determined using the data collected in the market surveys. Because of the non-replicable nature of the system, the effects of policies could only be inferred from observation of fluctuations in market prices and quantities of wildlife on sale. Two main types of conservation action were carried out during the project, with varying effects: law enforcement officials visited the markets, checkpoints were carried out on the road which dealers travelled down. The independent market monitoring was able to demonstrate the effects of each. An external organisation attempted to institute a captive breeding programme during the project; the effects of this policy were also monitored.

Staff employed

UK project staff (EJM-G, LC). Dealers discussed their incentives and the effects of different policies on them. Forestry & law enforcement officials worked together with us in carrying out continuous overnight checkpoints and market visits. Bart Wowor and James Komolontang assisted with checkpoints.

Research findings

Figure 2 shows the effects of our conservation efforts on the proportion of babirusas on sale in the market; it shows clearly that we were successful in significantly reducing the number of babirusas on sale in Langowan market.

In July 1998 an international meeting was held in Manado, North Sulawesi to promote a captive breeding programme. Darwin project staff expressed grave concern about this proposal at the time of the meeting. The meeting triggered a large demand for live babirusas from the wild, a demand that was unprecedented in the previous ten years of our involvement in market monitoring in North Sulawesi. This demand led to a substantially higher level of trade in babirusas, as the live animal trade occurred in addition to the underlying trade in dead babirusas for meat. Our long-standing relationships with wild meat dealers meant that we were given accurate details of this trade off the record, information that was proved to be correct during subsequent investigations by the Indonesian authorities.

The individual who was primarily responsible for driving this trade had no previous history of wild pig meat trading, but had been present at the international meeting in July. He issued an illegal letter authorising wild meat dealers to carry babirusas alive, copies of which were given to numerous dealers. Some refrained from using this letter, but others made use of it to

carry babirusas alive for subsequent sale in the markets. Animals were captured using these letters within protected areas. They were trapped using hunters' leg snares, consequently most were injured and many died following capture. They were transported on ordinary wild meat dealers' vehicles, often packed between live dogs and in full view.

Following the international interest in the captive breeding of babirusas, hunters and dealers gained the false impression that there was a potentially lucrative and officially sanctioned national and international demand for any live babirusas that they might catch. The chain of events we describe was a completely unintentional effect of a theoretical plan for babirusa conservation. However, it shows that considerable damage can be caused to the conservation of a species if management programmes are instituted without a full understanding of the practicalities of its conservation, particularly the interactions between the species and local people.

For more detail on the research findings, please see the attached manuscripts, "Trade in wildlife in North Sulawesi, Indonesia" and "Effects of a proposed *ex situ* conservation programme on *in situ* conservation of the babirusa".

Peer review

Preliminary results on the interventions carried out by this project were subject to peer review before acceptance as a chapter in the forthcoming book "Hunting for sustainability in tropical forests", edited by J.G. Robinson & E.L. Bennett (Columbia University Press). More detailed results are now being written up for submission to a peer-reviewed journal. The results of the analysis of the effects of the captive breeding programme were peer reviewed before being accepted for publication by the journal *Conservation Biology*.

- **Theoretical modelling of the spatial dynamics of the wild pig trade**

Methodology

In a previous study, we used a coupled map lattice model to calculate the equilibrium sizes of the Sulawesi wild pig and babirusa populations under open access harvesting. Coupled map lattice models have been successfully used in other areas of population ecology, and have predicted significant departures from the results of non-spatial models. The unusual features of the model include the use of the underlying structure of vegetation type and road location as the base for the model, rather than assuming a homogeneous environment. Also, global spatial distributions drive the dynamics, not a localised neighbourhood of sites, because spatial structure enters the model through the dealers' travel costs. However, this original model is too complex for analytical solutions, and does not allow for generalisations. In this part of the Darwin project, we developed simple generic one- and two-dimensional models to describe the dynamics of a single harvested population in which the harvest costs increase with distance from the market. We investigated the effects of changes in life-history parameters on the persistence of a hunted species at different distances from the market. We then showed the effect of harvesting two species together, with particular reference to the babirusa and the Sulawesi Wild Pig, and of alterations in parameter values. Finally we considered the effectiveness of various conservation strategies in the model.

Staff employed

The work was carried out by the three UK-based project team members (EJMG, LC, M. Keeling).

Research findings

A major issue for modelling population dynamics is the degree of complexity that is required in order to make useful predictions. This issue becomes particularly acute when the system under study involves an endangered species, such as the babirusa. Our previous research used a full spatial model, including detailed information about heterogeneities in vegetation type and the position and quality of roads. That model allowed us to make predictions about the actual locations where babirusas are likely to survive, which may be of use in policy-making. However, simple models, particularly those with analytical solutions, give us an intuitive feel for the dynamics of the system, which may be lacking in more complex models.

The simple one- and two-dimensional models we developed have allowed the analysis of the effects of parameter variation on the spatial persistence of wild pig populations in Sulawesi. The simple models have highlighted the fact that the spatial interactions are complex, highly non-linear and often produce counter-intuitive results. The model does not vary in any straightforward way as parameter values change, therefore great care is needed in attempting to infer the behaviour of one quantity from the measurement of others. For example, the size of the extinct region cannot be inferred from the number of pigs present in the marketplace. A more pertinent warning sign, as demonstrated clearly by these simple models, would be changes in costs, particularly transport costs. Examples include the practice of carrying pigs on ice, which effectively increases the number of pigs among which transport costs can be shared, or the recent improvement in road quality, which also decreases transport costs.

It is not generally appreciated that a more productive population is likely to have an extinct region that extends further from the marketplace than a less productive one, although the same proportion of the population is being harvested in each case. This insight has relevance to studies which compare the harvesting pressure on different species as a function of the distance from a settlement at which individuals are found. Differences in carrying capacity, on the other hand, do not change the position of the exploited region, except when carrying capacity is very low. The models we have developed could be widely applied to situations in which the spatial dimension is important for the dynamics of exploitation; those in which the harvesters' travel costs are significant. They are particularly useful when there is a single transport route to market.

For more detail on the research findings please see the attached manuscript "Spatial dynamics of two harvested wild pig populations".

Peer review

This study was peer reviewed before acceptance by the journal *Natural Resource Modeling.*

- **Forest mapping of wild pig habitat in North Sulawesi**

Methodology

The background to remote sensing in tropical forests was reviewed and a methodology developed for mapping the forests of North Sulawesi. AVHRR satellite images were used in

conjunction with ground truth data sets collected in North Sulawesi, in order to map the categories of vegetation present in the area. The AVHRR data were found to be adequate for this purpose, providing a compromise between acquisition frequency, range of spectral information and breadth of geographical coverage. Verification of the accuracy of the maps produced was carried out with independent field data to that used for classification of the images. The results of this verification were found to compare favourably with other similar studies, producing comparable accuracies. It was found that classification is less accurate for vegetation types with high spectral complexity, but when classified into three main categories of primary forest, secondary forest and agriculture/other, the best results were achieved, producing a higher percentage of pixels classified with improved accuracy. The resulting forest cover map was then compared to two other studies and a "best guess" final map was produced showing forest cover and deforestation fronts.

Staff employed

The staff involved were the UK project team (EJMG, LC), the 6 field assistants, and an MSc student from Warwick University (T. Evans).

Research findings

Figure 3 shows the forest cover map obtained from the mapping exercise. It clearly shows the extensive forest loss that has occurred recently, and that there is an influence of accessibility by road or river on forest loss; those areas which remain as primary forest are the least accessible. Babirusas are confined to primary forest, so are at risk not only from hunting but also from habitat loss. The next stage of our research will be to analyse a time series of AVHRR images using the techniques developed here, to assess the effects of habitat loss on babirusa populations. We will then link these results to our economic work on dealer travel times, so that the interaction between hunting and habitat loss can be assessed. This will have important implications for conservation, as it will suggest the correct weighting of conservation effort between controlling hunting and preventing further habitat loss.

Peer review

The findings were published as an MSc thesis submitted to Warwick University in 1998, and thus are in the public domain. They are also being prepared for publication.

Did any issues or difficulties arise in running or managing this project?

Two changes of Minister for Forestry during the project meant that relationships with them had to keep being re-established. The problems caused by the proposed captive breeding project described above took up a great deal of project time and effort.

---

7 PROJECT IMPACT

To what extent has the project assisted the host country to meet its obligations under the Biodiversity Convention, or to what extent is it likely to do so in the future?

A) The research findings have led directly to the following action by the Indonesian authorities:

• Gazetting of a 32,000 hectare nature reserve in the Paguyaman Forest, specifically for the protection of the babirusa, which is threatened by the wildlife trade. This is a site of international importance for global biodiversity, being one of the last strongholds of the babirusa in the world.

The project demonstrated the severe threat that the babirusa was under, and ecological surveys confirmed the high biodiversity in the region, together with the high level of threat that the forest faced (from legal & illegal logging, illegal settlement and poaching). Presentations from project staff to the Minister for Forestry encouraged him to act to protect this reserve, including gazettement and interim protection by soldiers. Presentations to local government officials have recently led to dramatically increased local enthusiasm, understanding and concern for safeguarding this site. Project employees also guarded the site from illegal activities for the duration of the project - without input from the Darwin project, this site would certainly have been destroyed during the lifetime of the project.

• Prevention of a damaging captive breeding programme, and arrest of a corrupt official in the Forestry Department.

The monitoring work carried out by the project allowed the swift detection of illegal capture of live babirusas for unsanctioned captive breeding programmes. This illegal capture was masterminded by a corrupt official, who was sacked and arrested following notification of the problem to law enforcement officials by the project team.

• Numerous checkpoints and market visits by officials to control the illegal trade in protected wildlife species.

The project provided expertise, staff and support for the mounting of five forty-eight hour continuous overnight checkpoints and numerous market visits. The checkpoints led to court proceedings being initiated against five dealers carrying protected wildlife species, and the confiscation and disposal of 36 babirusa, 5 macaques and 2 anoa (legally-protected endemic wild forest buffalo), all dead. A further 1 babirusa, 4 macaques and 1 bear cuscus (legally-protected marsupial) were confiscated, rehabilitated and released back into the wild. The market visits led to a clear drop in the number of babirusas being sold (see Figure 2), as well as to a raised public perception of the legal situation regarding trade in endangered species, and of the authorities' serious attitude towards its control. A number of dealers have now ceased to carry protected wildlife as a direct result of the project's efforts. The market monitoring has also led to a much improved knowledge and understanding of the wildlife trade, which will allow the authorities to improve the control of the trade in future. The project's modelling work clarified the policies that could potentially be used, and their effects on dealer incentives (particularly the importance of travel costs as a determinant of hunting rates in different locations, and the likelihood that without intervention, the wildlife trade will continue to expand).

• Habitat protection operations against illegal slash and burn agriculture and illegal timber removal.

The project provided information about illegal habitat destruction, and helped to apprend a number of the perpetrators. Project staff supported the Forestry Department in law

enforcement operations. This acted as a powerful deterrent to further habitat destruction. In one operation in 1997, four illegal chain-saws were confiscated. In an operation in August 1999, 70 m^3 (11 lorry-loads) of illegal timber was confiscated. These actions have helped to mobilise a group of concerned forest protection officials, and represent considerable progress for the enforcement of forest protection laws. It is a step towards improved transparency in natural resources management by the Government of Indonesia.

In future, the project's work will:

- Help to improve management of rattan stocks in the province, by improving understanding of rattan population dynamics, trade structure and sustainable levels of harvest.

- Leave a legacy of awareness about wildlife laws, and of enthusiasm for the conservation of Sulawesi's endangered endemic species.

B) The training provided has improved the capacity of the host country to conserve biodiversity in the following ways:

- Training of ex-hunters as field assistants.

This has had a major impact on the perceptions of hunters and their villages, raising awareness of the importance of biodiversity conservation, and the effects of hunting on wild pig populations. It is expected that the field assistants will continue to work in conservation of the babirusa, with the team leader in Indonesia (LC).

- Training of law enforcement and forestry department officials to carry out checkpoints and market surveys.

This has improved the capacity of these officials to uphold the law. As they will continue to work in their present jobs, this will lead to long-term improvements in biodiversity conservation in the Province.

- Training of research students.

One of the project's counterparts, Mr A.H. Mustari, has gone on to obtain a scholarship from the Australian government for a PhD based at the University of New England, Australia. He will work on the ecology and conservation of the anoa in Sulawesi.

C) The project has led to an increase in collaborative links between UK and Indonesian institutions in the following ways:

- British scientists are now identified in North Sulawesi as dedicated and serious conservationists, and in carrying out the project have built strong relationships not only with Indonesian scientific institutions but also with military and police officials, church, Ministers and a wide range of other government officials, as well as hunters, village heads and wildlife and rattan traders.

• Outstanding working relationships have been established between project staff and the provincial forestry office and future applications to DFID for collaborative projects are planned.

• One Indonesian project counterpart, Mr A.P. Sarjono, is currently pursuing opportunities for British Council (Chevening) funded studies in the UK.

---

8 SUSTAINABILITY

Did the host country contribute resources to the project, and if so, what was their monetary value?

Yes, the host country contributed the following resources:

Staff time of officials from the following Departments:

Forestry Department (Manado and Gorontalo Districts) - 6 hours per month by each of 3 officials [redacted]

Local police forces in Manado and Gorontalo districts (staff for wildlife law enforcement operations).

Forest protection support.

Army Special Elite forces personnel. 8 months of forest protection by each of 2 officers; [redacted]

Forestry guards. 4 months by each of 2 guards. [redacted]

In kind provision of rooms for meetings by local Forestry Department.

Mr Agung P. Sarjono was funded by the Indonesian Forestry Society for his flights and costs during his work with our project in the field.

To what extent was the Darwin funding a catalyst for attracting resources from other sources? What is the monetary value of these resources?

Resources were attracted from the following sources:

People's Trust for Endangered Species [redacted] during lifetime of the project, and a minimum of [redacted] for the continuation of project work).

Whitley Award Scheme for International Nature Conservation [redacted]

William Edwards Education charity [redacted] towards the forest mapping component of the project, as a bursary for Mr T. Evans)

British Airways Assisting Conservation [redacted] in kind as an airfare from the UK to Sulawesi)

In the future, we anticipate that further funding will be obtained to continue the work of the Darwin Project. The World Bank has already expressed interest in funding a GEF programme based on the work carried out by this project.

9 OUTCOMES IN THE ABSENCE OF DARWIN FUNDING

Had Darwin funding been unavailable for the project, the most likely outcome would have been that some aspects of the project would not have proceeded at all (in particular the rattan work). Other aspects may have been delayed or proceeded at a much reduced scale (for example the market monitoring). However, there was a strong possibility that none of the project would have gone ahead.

If the project had not been undertaken, the beneficiaries of the project would not have met their requirements. It is virtually certain that the babirusa's last stronghold in the Paguyaman Forest would have been destroyed, rather than being gazetted as a Nature Reserve, and that the trade in babirusas would have continued unabated. There were no other organisations or initiatives that would have met the needs of the beneficiaries.

10 KEY POINTS

What would you identify as the key success factors of this project?

The key success factors were:

- The long experience that LC already had with conservation work for traded wildlife species in North Sulawesi, and her existing good relations both with local hunters, rattan collectors and with officials at the national level. This meant that we were able to start the project from a pre-existing research and conservation base, rather than from scratch.

- The dedication of the field staff and many of the officials from the Department of Forestry, that meant that they were fully committed to the project.

What were the main problems/difficulties encountered by the project?

- The fact that we were unable to fund a PhD place (it was cut from our original proposal), and therefore could not employ a highly-qualified Indonesian staff member as a researcher and to help lead the project. This meant that less could be done that otherwise would have been possible. There were several people with whom we collaborated, who would have been very keen to take a full active role in the project, had a PhD been on offer. This would have left more of a lasting legacy from the project, as there would have been a highly qualified, dedicated person in Indonesia, keen to carry the work on in the future.

- There was considerable political turmoil in Indonesia during the period of the project. However these caused minimal disruption to the project, because North Sulawesi remained entirely calm throughout. The main problem was the turn-over of senior officials and the

replacement of the Minister of Forestry, necessitating a visit to Jakarta to explain the rationale behind the project and the need for it to the new Minister. Both Ministers were very supportive of the project after presentations by the project team.

• During the project, a misguided international captive breeding scheme was proposed (see the attached manuscript for a description). This disrupted the project considerably, and countering its damaging effects on the babirusa trade took up a lot of LC's time.

What are the key lessons to be drawn from the experience of this project?

• There is a need to be flexible in the running of a project such as this. Conservation projects in developing countries work best if there is an ability to react to events. The Darwin project was successful in this, riding the political problems in Indonesia, and succeeding in conservation goals such as getting the Nature Reserve gazetted, that were dependent on the decisions made by host country officials, and thus could not be listed as potential outputs in the original proposal.

• In order to get maximum benefit for the host country, there is a need to fund high-level training (e.g. PhD-level training for project staff) as well as grass-roots training.

• Personal relationships are key to the success of projects in South East Asia. Ground level projects achieve the most, by influencing the decision-making of those who actually use the resources that we are trying to conserve. The fact that LC has been working towards the gazetting of the Paguyaman reserve for the past 8 years demonstrates that perseverance wins in the end in achieving conservation goals!

Does the experience of this project imply a need to review arrangements for developing & managing projects funded as part of this Initiative?

No, the project was overall very successful, and the Darwin Initiative team were extremely helpful throughout.

---

11 PROJECT CONTACTS

UK project leader & other key UK staff

Dr E.J. Milner-Gulland. Renewable Resources Assessment Group, T.H. Huxley School of Environment, Earth Sciences & Engineering, [redacted]

Dr Lynn Clayton. Renewable Resources Assessment Group, T.H. Huxley School of Environment, Earth Sciences & Engineering [redacted]