Saving the pygmy hog

Devising the way forward: Assessing conservation needs and actions 2003-2005

A briefing book

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March 2003

Summary
This report contains summarised information on the facilities, resources and outputs of the Pygmy Hog Conservation Programme (PHCP).

- The pygmy hog *Sus salvanius* originally ranged along the Himalayan foothill savanna belt from Nepal to Assam. It is now Critically Endangered, with only a single population remaining in Manas National Park, Assam.
- The Trust has been involved in the species since 1971 but the PHCP was launched in 1995.
- The PHCP has a well-run breeding centre and the 70 captive hogs are currently being managed to limit reproduction.
- There is an urgent need (the centre is at capacity) to review the role of the captive population, with "as a source for release" i.e. a recovery population, being a strong recommendation.
- The PHCP operates under an MOU (Durrell Wildlife Conservation Trust, Ministry of Environment and Forests Government of India, Forest Department of the Government of Assam, IUCN/SSC Pigs, Peccaries and Hippos Specialist Group), the first of its kind in India.
- The PHCP is widely involved in a range of extension activities with a very broad range of stakeholders. In addition it is very active in teaching (schools, colleges, universities, zoos, government, etc).
- It is fair to say that the activities of the PHCP are raising the bar in conservation biology in Assam and the North East.
- There is a good publication record, focused mostly on field survey/ conservation assessment and captive management (including veterinary health).
- Like many projects, the active conservation work has to move forward in tandem with political work. The Manas area is beset with security problems, and the local government is highly bureaucratic and under-resourced. The situation is complicated by the need to seek approval from both the national and State Governments.
- Recent changes in senior officials and the forthcoming visits of William Oliver to Jersey and India provide an opportunity to drive the project forward.

This report provides a "briefing book" emphasising the current situation and acts as a basis for forward planning. Much of this has been drawn from documents prepared for the PHCP Strategic Planning Meeting held in Jersey in July 2002. The minutes of those meetings are in Appendix 1. Operational plans drawn up in October 2002 are in Appendix 2.

Acknowledgements
With many thanks to Goutam Narayan, William Oliver, Parag Deka, John Hartley and Kay Johns.

Remit
This report was requested as a working document/summary that would be helpful in investigating the future of the pygmy hog project and DW involvement more thoroughly. In particular to help provide a means to assess objectively what is required to conserve the species in the future.

This document covers the following areas:
1) Current situation (brief outline, including quality of stock)
2) Outputs (publications, publicity, training of nationals etc.)
3) Costings (expenditure and income since start of project)
4) Involvement and relationships with nationals and national institutions (training, research, other work)

Methods

This report has been condensed and extracted from a variety of documents (mostly grey literature) and has benefited from input and review by Goutam Narayan, William Oliver and John Hartley.

Documents consulted

Deka, PJ and Narayan, G (2002) Pygmy Hog Conservation Programme monthly reports Jan-Dec 2002.

Deka, PJ and Narayan, G (2003) Pygmy Hog Conservation Programme monthly reports Jan-Feb 2003.

DW, PHCP (2002) *Notes on Pygmy Hog Meeting, held at Durrell Wildlife Conservation Trust Jersey, 11th July 2002.* Unpubl.

DW, PHCP (2002) *Pygmy Hog Conservation Programme Operational Plan*. Durrell Wildlife Conservation Trust, October 2002.

Narayan, G (2002) *Justification, Plans and Budget for a Second Breeding and Pre-release/Holding Centre for Pygmy Hogs – including Site Selection Surveys*. Unpubl. report, Pygmy Hog Conservation Programme.

Narayan, G (2003) *Pre-release cum Breeding and Holding Centre for Pygmy Hogs*. Unpubl. report, March 2003.

Narayan, G and Deka, PJ (2003) *Pygmy Hog* Sus salvanius *Stock Register* (to 31/12/2002). PygmyHog Conservation Programme.

Narayan, G, Deka, PJ, Chakrobarty, A and Oliver, WLR (1999) Increase in the captive population of pygmy hogs *Sus salvanius*: Health problems and husbandry. *Dodo* 35: 70-86.

Narayan, G, Deka, PJ and Oliver, WLR (1998) *Pigmy Hog Conservation Programme Third Annual Report 1997*.

Narayan, G, Deka, PJ and Oliver, WLR (2002) *Pygmy Hog Conservation Programme Summarised Progress Report 1995-2002.*

Narayan, G and Oliver, WLR (in press) Pygmy Hog *Sus salvaniu*. In: *Mammals of South Asia,* Johnsingh, AJT *et al*., eds. Permanent Black, New Delhi.

Narayan, G, Oliver, WLR and Deka, PJ (1999) *Pigmy Hog (*Sus salvanius*) Conservation Programme Consolidated Report for Phase I (1995-1998)*.

Narayan, G, Oliver, WLR and Deka, PJ (2002) *Pygmy hog,* Sus salvanius*, Causes of Decline, Conservation Objectives and Action Points for the Species' Recovery Programme*. Unpubl. report, Pygmy Hog Conservation Programme.

Oliver, WLR (1980) *The Pigmy Hog. The Biology and Conservation of the Pigmy Hog* Sus (porcula) salvanius *and the Hispid Hare* Caprolagus hispidus. *Jersey Wildlife Preservation Trust Special Scientific Report* No. 1. Jersey Wildlife Preservation Trust, Jersey.

Oliver, WLR and Narayan, G (1996) *Pigmy Hog (*Sus salvanius*) Conservation Programme First Annual Report (to 31st December 1995)*.

Oliver, WLR, Narayan, G and Raj, M (1997a) The Pigmy Hog *Sus salvanius* Conservation Programme: Background description and report on progress to end December 1996. *Dodo, Journal of the Wildlife Preservation Trusts* 33: 45-71.

PHCP (1995) *International Conservation Management and Research Memorandum of Understanding. Action Plan for the Conservation of the Pigmy Hog* Sus salvanius *Phase II*.

PHCP, DW (2002) *Pygmy Hog Conservation Programme Background Notes for Strategic Planning Meeting, Durrell Wildlife Conservation Trust, 10-11th July 2002*

Introduction

Brief history

Classified by the IUCN as Critically Endangered, the pygmy hog *Sus salvanius* is known only from a single location in Assam, India. This relict population is under considerable threat from improper habitat management, inadequate habitat protection and regional security problems.

In the 1960s Jersey resident Captain Tessier-Yandell contacted Gerald Durrell informing him that he was going to Assam to manage a tea plantation Although the species was first recorded in 1847 very little was known about it. As some authors then considered it to be extinct GD suggested that he make enquiries throughout the region to see if it was possible that a small population still existed.

In 1971 extensive fires drove pygmy hogs out from their preferred habitat of thatch grassland into a tea garden. Several animals were captured and maintained on one of the estates. Jeremy Mallinson visited to advise on husbandry and several litters were born. Between 1971 and 1977 at least 45 pigmy hogs were acquired and at least 40 were born in captivity. By the mid 1980s none had survived.

William Oliver (then Trust Research Assistant) carried out extensive fieldwork during 1977, the results of which were published in the Trust's Special Scientific Report No.1. In 1985, following further Trust-sponsored visits to India, he was invited by the Director of Wildlife (Government of India) to submit an action plan for the species' conservation. This was formally accepted in 1988. This plan comprised 1) A field status survey of selected areas within the known range of the species; 2) The initiation of a properly structured cooperative breeding programme; and 3) The initiation of longer term field studies of the behaviour and ecology of the species and 4) the formulation of criteria for the enhanced future management of its early successional, tall grassland habitat. The Wildlife Division of the State Forest Department Assam was charged with implementing the recommendations, but subsequently failed to do so. In November 1991, a revised plan was submitted, and three years later a recovery programme was finally approved under the auspices of a new International Conservation Management and Research Agreement for the Pygmy Hog (ICMRA). This Agreement, the first of its kind in India, was signed in February 1995 by the Ministry of Environment and Forests, Government of India, Forest Department, Government of Assam, the IUCN/SSC Pigs and Peccaries Specialist Group and Durrell Wildlife Conservation Trust (then Jersey Wildlife Preservation Trust). This agreement was renewed for a further 5 year period on 4th March 2001, at which time a new ‘Governing Body’, comprising representatives of the above parties and other local NGO and academe, was established to assist monitoring and development of the recovery programme.

The Trust committed to this project and funded it prior to obtaining a 3-year grant (1995-1998) from the European Union. The project then made good progress and a breeding centre was designed and built at Basistha, on the outskirts of Guwahati, Assam State on land provided by the Forest Dept of Assam. Six wild hogs were captured in Manas National Park,(with substantial logistical support from the Forestry Dept of Assam), which now supports the only viable population of this species. By 31 December 2002 this stock had increased by nearly 1,200% to 70 animals (33.37), despite institution of management regimes to reduce population growth over the past 4 years (see later text).

A chronology of events to mid-2002 is given in Appendix 2.

Current conservation status

The pygmy hog is currently classified by IUCN as Critically Endangered (see Box 1). The remnant wild population appears to persist only within Manas National Park, possibly extending into some of its buffer reserves, and although there are no population estimates, is likely to number in the low hundreds.

Box 1. Conservation status of the pygmy hog CR A1c, B1+2cd, E

A. Population reduction
- 1. An observed, estimated, inferred or suspected reduction of at least 80% over the last 10 years or three generations, whichever is the longer, based on
  - c. a decline in area of occupancy, extent of occurrence and/or quality of habitat

B. Extent of occurrence estimated to be less than 100 km^2 or area of occupancy estimated to be less than 10 km^2, and estimates indicating any two of the following
- 1. Severely fragmented or known to exist at only a single location
- 2. Continuing decline, observed, inferred or projected, in any of the following:
  - c. area, extent and/or quality of habitat
  - d. number of locations or subpopulations

E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer.

IUCN Red List www.redlist.org
Mace, GM and Balmford, A (2000) Patterns and processes in contemporary mammalian extinction. In *Future Priorities for the Conservation of Mammalian Diversity*, Entwhistle, A and Dunstone, N (eds). Cambridge University Press, Cambridge, pp. 27-52.

Surveys
Rapid field surveys for hogs and an assessment of grassland habitat management practices have been carried out in all protected areas in the Brahmaputra valley within the pygmy hog's former range, as well as in two protected areas outside it. Surveys were based on interviews and site visits to search for field 'sign' (forage marks, faeces and nests). Details are given in Table 1.

Table 1. Surveys for pygmy hogs 1995-2002

State/area	District	Site	Survey period	Hog status	Remarks
Western, Northwestern and Central **Assam**	Kokrajhar District	Kochugaon Reserve Forest	1995-96	None (reported in 1970s)	No suitable grassland habitat left; extensive human encroachment
		Ripu Reserve Forest	1995-96 1999-2000	Hogs suspected	Little suitable grassland habitat left, mostly along Bhutan border
	Kokrajhar and Bongaigaon Districts	Bengtol Reserve Forest	1995-96	None (reported in 1970s)	Very little suitable grassland habitat left
		Chirang Reserve Forest	1995-97, 2000-01	Hogs suspected	Little suitable grassland habitat left, mostly along Bhutan border
	Bongaigaon District	Kuklung Reserve Forest	1995-96	None	No suitable grassland habitat left; extensive human encroachment
	Bongaigaon and Barpeta Districts	Manas Reserve Forests	1995-97, 1999-2001	Hogs present but rare and highly threatened	Suitable grassland habitat in some parts, threatened by tree plantation by Forest Dept. Plantations stopped but human encroachments expanding
	Bongaigaon, Barpeta and Nalbari Districts	Manas National Park	1995-2002	Hog population in lower hundreds	The last remaining habitat of the species. Habitat threatened due to poor protection and management
	Nalbari District	Subankhata Reserve Forests	1995-96, 1998-99	Continued survival doubtful	Evidence of a small number of hogs in 1995 but not during later visits; habitat degraded and disturbed
	Nalbari and Darrang Districts	Pagladia Reserve Forest	1995-96	None	No suitable grassland habitat left
		Daranga Reserve Forest	1995-96	None	No suitable grassland habitat left; extensive human encroachment
	Darrang District	Barnadi Wildlife Sanctuary	1995-2002	Continued survival doubtful	Few footprints seen in 1995 but no subsequent evidence. Sanctuary staff have not seen the species since 1989.
		Khalingduar Reserve Forest	1995-96, 2000-01	None (present till 1976)	Little suitable habitat left. By 2001, little protection and rampant encroachments.
		Corromore Unclassed State Forest	1995-96	None (reported in 1970s)	No suitable grassland habitat left; extensive human encroachment
		Rowta Reserve Forest	1995-98, 2001-02	None (definitely present till late 1970s)	Little suitable grassland habitat left. No protection. Rampant human encroachment.
		Orang National Park	1995-2002	None	Habitat appears suitable but the grasslands are flood prone, probably the reason the species was never reported.

	Goalpara District	Foothills adjoining Meghalaya border	1997-2001	None	No suitable habitat found. Contemporary records from 1950s-1960s.
	Morigaon District	Pabitora Wildlife Sanctuary	1995-2002	None	Habitat appears suitable but the grasslands are flood prone, probably the reason the species was never reported.
	Nagaon District	Laokhowa Wildlife Sanctuary	1996, 1999	None	Some flood prone grasslands with no past record. Current protection poor.
	Nagaon and Golaghat Districts	Kaziranga National Park	1995-2002	None	Habitat appears suitable but the grasslands are flood prone, probably the reason the species was never reported.
	Sonitpur District	Burachapori Wildlife Sanctuary	1996, 1999	None	Habitat appears suitable but the grasslands are flood prone, probably the reason the species was never reported.
		Sonai-Rupai Wildlife Sanctuary	1996-2002	None (reported in 1940s)	Pockets of suitable grassland exist. Some encroachment but protection is improving slowly. Reintroduction may be considered.
		Balipara Reserve Forest	1995-98, 2001-02	None (present till late 1970s)	Little suitable grassland habitat left. No protection. Rampant human encroachment.
		Nameri National Park	1995-2002	None (probably present till 1970s)	Although better protected, suitable grasslands exist only in valleys in this largely hilly Park. Potential trial reintroduction site.
		Nauduar Reserve Forest	1998-2002	None (present till late 1970s)	Little suitable grassland habitat left. Poor protection, human encroachments.
		Panpur Reserve Forest	1998	None	Grasslands flood prone and not suitable for the species.
		Behali Reserve Forest	1997	None	Except some tiny pockets in the north the habitat is unsuitable.
		Gohpur Reserve Forest	1997	None (present till late 1970s)	No suitable grassland habitat left; extensive human encroachment
Northeastern **Assam**	North Lakhimpur District	Reserve Forest along Arunachal Pradesh border	1997-98	None	No suitable grassland habitat. No past record

	Dhemaji District	Kobo Chapori	1998, 2000	None	Some suitable grassland, mostly flood prone. No past record.
	Sibasagar District	Foothills adjoining Nagaland's Mon District	1999	None	No suitable habitat. Past unconfirmed reports from adjoining areas.
	Dibrugarh and Tinsukia Districts	Dibru-Saikhowa National Park	1998, 2000	None	Some suitable grassland, mostly flood prone. No past record
Southern **Assam**	Cachar District	Surma Valley	1997, 2001	None	No suitable habitat found. Contemporary records from 1950s-1960s.
	Karimganj District	Surma Valley	1997, 2002	None	No suitable habitat found. Contemporary records from 1950s-1960s
	Hailakandi District	Innerline Reserve Forests	1997, 2001	None	No suitable habitat. Past unconfirmed reports.
Nagaland	Mon District	Areas adjoining Sibasagar District, Assam	1999	None	No suitable habitat. Past unconfirmed reports.
Mizoram	Bhairabi area	Areas adjoining Hailakandi District, Assam	1997, 2001	None	No suitable habitat. Past unconfirmed reports from adjoining areas.
Southern **Arunachal Pradesh**	West Kameng District	Bhairab-kunda and Balimu area in the foothills	1999	None	No suitable habitat of adequate size.
	East Kameng District	Pakhui Wildlife Sanctuary and areas adjoining Nameri NP of Assam	1997, 2000	None	No suitable habitat of adequate size. Terrain mostly hilly.
	Popumpare District	Holongi near Gohpur RF, Assam	1997, 2000	None	No suitable habitat left.
	East Siang District	D'Ering Memorial Wildlife Sanctuary	1997, 2000	None	Habitat appears suitable but most grassland are flood prone. No past record. Little protection against hunting.
		Siku grasslands near Mebo Reserve Forest	1997, 2000	None	Some grassland appear suitable but most areas undergo prolonged inundation. No past record. Hunting rampant.
	Dibang Valley District	Dibang Reserve Forest	1997, 2000	None	Some grassland appear suitable. No past record. Hunting common.
	Lohit District	Paya and Digaru Reserve Forests	1997, 2000	Unknown	Grassland patches not large but some are suitable. Hunting common.
	Changlang District	Near Namdapha National Park	2000	None	No suitable habitat.
Meghalaya	West Garo Hills District	Balphakram National Park grasslands	1998	None	No suitable habitat. A patch of highland grassland in hilly forests.
	Areas adjoining Goalpara District of Assam	Foothill	1998-2001	None	No suitable habitat found. Contemporary records from 1950s.

Clearly the pygmy hog appears to have declined dramatically and has disappeared from most of its former range. Much of this appears to have happened since the late 1970s (when several Reserve Forests in Assam still had pygmy hog populations) and to be due to severe habitat degradation and human encroachment. The only population known to exist is in the Manas NP, although there may be animals still in Bhutan (the only part of its former known or postulated distribution which has not yet been surveyed).

Causes of decline

There are multiple and interacting causes of decline, illustrated in the flow diagram.

Loss of Populations

Agricultural expansion and human settlements in the 20th century have transformed land use over most of the hog's former range, leading to large-scale habitat loss. Human population explosion and settlement of displaced people in northern India was largely responsible. Other habitats were also lost due to: inundation by irrigation projects (e.g. Kosi Barrage, Nepal), prolonged seasonal flooding due to extensive deforestation of neighbouring uplands (e.g. in Brahmaputra Valley), or disruption of successional sequences following flood control measures (e.g. loss of all early successional habitats in northern Uttar Pradesh).

Habitat Degradation

Degradation of habitat causes major loss of essential resources and led to decline in number of individuals in remaining populations, even those in protected areas. This decline continues. There are five main causes of habitat degradation.

Grass burning: Indiscriminate grass burning carried out by protection staff or by local people. Grass is burnt ostensibly to promote fresh growth (by Forest Dept. personnel) or to get better stands of thatch (by local villagers or thatch-grass harvesters). Often it is done to improve ground visibility as a safety measure against potentially dangerous mammals (e.g. elephant, tiger, buffalo, rhino), and rarely to clear debris to prevent hotter burn.

Livestock grazing: Livestock from the villages near PAs degrade the grassland habitat, cause considerable disturbance and are liable to introduce diseases. Burning is also undertaken by livestock owners to promote new growth of vegetation, though this promotes growth of fire-climax species that are mostly unpalatable, except as emergent shoots.

Collection of thatch and other produce: Organised or casual collection of thatch has also been a prominent cause of habitat degradation and disturbance. Fire is used to obtain purer stands of thatch.

Human encroachment: Illegal human encroachment to establish new settlements and convert former grasslands and riverine forest into farmland destroys habitat rapidly.

Afforestation: Planting of commercially valuable species of trees in grasslands is often done in the name of 'saving' them from people. If these are successful, they inevitably transform former grasslands into low biodiversity plantations. If these fail, the damage is often irreversible.

Habitat transformation

Until the1950s and 1960s large parts of the terai, duars and Assam valley were subject to continual changes in watercourses, which prompted natural successional sequences in vegetation communities (including formation of new grasslands). However, following construction of flood controls or other factors all (of the few) remaining early grasslands are now highly fragmented and reduced to small, highly disturbed patches and/or superseded by later successional communities.

Mortality
Burning results in the normally secretive hogs being forced into unsuitable cover (e.g. tea estates) or "trapped" in remaining unburned swards, where they are subject to intense hunting pressure or other disturbances. These tiny "floating" populations are easily eliminated, reducing the population further.

Conservation Intervention

Establishing a captive breeding population of pygmy hogs
This has been successfully achieved with the design and construction of a Research and Breeding Centre at Basistha. This comprises four animal units (Durrell House, Magor House, Mallinson House, and an Isolation Unit), a project house/office/laboratory, and a caretaker's house. The campus is enclosed within a high chainlink fence and adequate measures have been taken to protect the centre and animal enclosures from intruders and predators.

Each animal house was designed around a central service area and inside enclosures (stalls) interconnecting with adjacent stalls and one or more outside enclosures (paddocks) via a system of drop slides, operated from the service area. Stable-type doors provide access to the stalls. Numerous mesh screen windows were set on inside and outside walls; a high pitched roof and exhaust fan-assisted ventilation help reduce heat and increase air circulation. Lighting and electric ceiling fans were also provided in the stalls and service area.

The outside enclosures were also planted with tall grasses – mostly *Narenga porphyrocoma* and *Imperata cylindrica* collected from original hog habitats in Manas and Barnadi. The Durrell House enclosure is used as the main breeding unit and consist of nine stalls (each of 8-9 m^2) each connected to bird-proof paddocks (40 m^2 to 200 m^2). The Magor (10 stalls and paddocks) and Mallinson House enclosures (5 stalls and paddocks) were constructed later at Basistha and are mainly used as holding units. Isolation Unit (2 stalls and paddocks) is used for hogs needing intensive treatment.

The centre is the only site where pygmy hogs are maintained in captivity and is a centre for research in husbandry and management techniques. Breeding has been successfully established, so much so that it is now being managed to reduce output. Trials of the contraceptive Medroxyprogesterone Acetate (Depo-Provera) are currently underway. The project has received considerable veterinary input, including locally and from DW. The current hog population stands at 69 (32.37) (February 2003). Nine founders have contributed to the population and another wild-caught male has yet to breed. The Basistha site also acts as a training centre for a wide range of personnel (see below).

Work is underway to establish a suitable enclosure and train staff in pygmy hog husbandry for an exhibit of pygmy hogs in Assam State Zoo.

Establishing a support facility
The selection of three alternative sites for establishing a Phase II Support Facility is complete. These are (i) Hornbill Park, located in Dharamtul range of Khulahat Reserve Forest, Morigaon district (ii) 10 ha plot located across the Jia-Bharali river from Nameri National Park, next to the Potasali Range Office, and (iii) Dekorai tea estate in Sonitpur District. While the former two sites belong to the Forest Department, Govt of Assam, the latter is under Williamson Magor Group of tea companies. It is anticipated that the sites will be leased to PHCP free of cost. However, additional funds may be required for the purchase of private landholding. Criteria for site selection are given in Box 2.

Box 2. Criteria for selection of Phase II Support Facilities

1) Flat, open, well-drained land, free from risks of flooding and herbicide or insecticide contamination, and suitable for the construction of breeding enclosures/other facilities
2) Size ranging between 3 and 5 ha
3) Absence of human settlements within 100 m of its perimeter, as well as any domestic animal (specially pig) breeding activity in the surrounding area
4) Availability of clean drinking water, electricity and telecommunication facilities
5) Well connected to Guwahati, preferably by public transport, at all times of the year, for project personnel or consultants from the Veterinary College, Guwahati, to access the site quickly (within 3 hours or so) in any emergency
6) Free from any risk from wild elephants and other destructive wildlife
7) Free from security risks
8) Located within 2-3 km of a market

From Narayan, G (2003) *Pre-release cum Breeding and Holding Centre for Pygmy Hogs*. Unpubl. report, March 2003.

Grassland management

A field camp was re-established in Manas in 2001 with a fulltime field biologist based there collecting data on current grassland management practices in different seasons and preliminary information on diversity of selected species in the grasslands under different management regimes. Information on grass associations and vegetation patterns are also being gathered and the effect of burning on the grass and other vegetation is being assessed. Post burning re-colonisation and monitoring of flora and fauna is being undertaken by vegetation sampling, bird census (line transects) and mammalian pellet counts.

Replicate grassland plots have been established in Manas NP and Orang NP (disturbed, marginally disturbed, undisturbed). Steps have been initiated to set up similar plots in Nameri NP

Preliminary trends indicated by initial results of these studies have reinforced the hypotheses that grasslands plots that are burnt regularly every year, or experience frequent livestock grazing and other anthropogenic disturbances, have significantly less floral and faunal (birds, mammals) diversity compared to undisturbed plots that are burnt less frequently. Moreover, apart from promoting fire resistant species of grasses and shrubs, these disturbed plots are rapidly colonised by silk cotton (*Bombax ceiba*) trees changing the character of the habitat and making it less suitable for sensitive species such as the pygmy hog and Bengal florican.

Research leading to better management and preservation of important grassland habitats in north-eastern India, which are one of the richest in the Indian subcontinent in terms of their biodiversity, would also have obvious benefits for other key species in these threatened habitats, including the one-horned rhinoceros, wild buffalo, swamp deer, tiger, hispid hare, and Bengal florican

Outputs

Extension programme and collaborations

The PHCP appears heavily involved in extension activities with a wide range of people: villagers around Manas NP, and other target groups, students, teachers, foresters, bureaucrats, decision makers in Guwahati, etc. The PHCP also appears to have developed a number of working relationships with a variety of institutions and to participate in various capacity development initiatives. These cover university zoology, veterinary, wildlife diploma and

MSc students, forestry service personnel and zoo staff from keeper to director level. The PHCP lectures to about 775 people in conservation breeding/wildlife health and conservation education initiatives on an annual basis. Through these and technical meetings it appears that the PHCP is generally raising the bar in Assam and the North East in conservation biology. Details are given in Box 3.

Manas NP

The Programme staff participate in all educational and extension activities of the Project Tiger authorities for the people living in or near the in Manas NP. These include stakeholders' workshops, public hearings, exhibitions, and audio-visual programmes for school children, local villagers, and forest department and police personnel. The project field biologist works directly with groups of youths from the fringe villages of Manas Tiger by delivering lectures to the students of local schools and colleges, organising bird counts and nature walks, and also tries to engage with local wildlife poachers. Since high unemployment and lack of income generation is driving people towards illegal activities in the NP, the PHCP (with Project Tiger staff) helped a number of local youth to receive free vocational training at the State Institute of Rural Development, Guwahati.

The PHCP has reached an agreement with the Green Hearts Nature Club of Kokrajhar, Assam, and is negotiating with the Community Conservation Inc., Wisconsin, USA, and Forest and Wildlife Conservation Forum, Bongaigaon, Assam, for cooperation in conservation awareness generation and community participation programmes in the Manas Tiger Reserve, in areas both near and far from the core National Park. The PHCP is working with Project Tiger to have input to the Research and Conservation Education Section of a Visitor's / Interpretation Centre under development at Bansbari in Manas NP so that visitors to the NP and locals understand the conservation principles and learn how protecting grassland habitat and species benefit both people and wildlife.

Basistha and elsewhere

The Basistha Centre is regularly visited by groups of school and college/university students. Talks and demonstrations on biodiversity conservation in the tall grasslands of Brahmaputra valley and on the importance of conservation breeding are given. Regular target audiences include zoology department students of Gauhati University and other colleges of the state, veterinary college students, trainees of the Forest Rangers' College, Guwahati, Assam Forest Protection Force personnel, and officers of the Indian Forest Service and other administrative services, specially those attending the Refreshers Courses at the Administrative Staff College, Guwahati. In addition, the project provides lectures to Zoo and Wild Animal Management Courses for Zoo Directors or Senior Staff organised by Wildlife Institute of India and Central Zoo Authority, as well as to trainees of the Zoo Keepers' Training Courses for North-Eastern India. The project is also involved in teaching in conservation breeding to Wildlife Diploma trainees (mostly middle level forest officials) and MSc (Wildlife) students. The project personnel participated in relevant workshops and meetings on wildlife conservation organised by NGOs or others (e.g. on the occasion of Wildlife Week etc.) and networked with conservationists on conservation issues of the region.

Box 3. Collaborations with Indian institutions and individuals (research, training, etc.)

Management and Protection of Natural Grassland and Pygmy Hog (follow-up visits/meetings twice a month)

- Forest Department, Govt. of Assam
    - Principal Secretary / Commissioner (Forests), Secretary / Joint Secretary (Forests), Principal Chief Conservator of Forests, Govt. of Assam
    - Chief Conservator of Forests (Wildlife), and Conservator of Forests (Wildlife), Assam
    - Director Project Tiger and other officers of Manas National Park (NP)
    - Divisional Forest Officer (Wildlife), Mangaldai, and officers of Barnadi Wildlife Sanctuary (WLS) and Orang NP
    - Divisional Forest Officers (DFO), Tezpur, and officers of Nameri NP, Burachapori and Sonai Rupai WLS
    - Conservator of Forests, Western Assam Circle and DFO, Kokrajhar
    - DFO (Wildlife), Nagaon, and officers of Pabitora and Laokhowa WLS
    - Director, Kaziranga NP and DFO Eastern Assam Wildlife Division
- Gauhati University
    - Prof. P. C. Bhattacharya and other faculty members of the Department of Zoology
    - Department of Botany
- Bombay Natural History Society
    - Dr. A. R. Rahmani
- Wildlife Institute of India

Habitat Conservation in Manas Tiger Reserve (attendance in workshops/advisory meetings, 3-4 times a year)

- UNESCO World Heritage Site Biodiversity Programme
    - Manas Tiger Reserve (Director Project Tiger)
    - Ashoka Trust for Research in Ecology and Environment (ATREE) (Prof. Kamal Bawa and Dr. Jagdish Krishnaswamy)
    - IUCN-WCMC, Protected Area Conservation Systems and Management Planning (Mr. Bruce Jefferies)
- Conservation and Livelihood Network
    - Kalpvriksh
    - Natures Foster

Conservation Breeding of Pygmy Hog (monthly/case-by-case advisory meetings, follow-up visits)

- College of Veterinary Science, Assam Agricultural University (particularly the following faculty):
    - Prof. Apurba Chakraborty, Department of Pathology
    - Dr KK Sarma, Department of Surgery
    - Prof. Habibur Rahman (now with Indian Council of Agricultural Research), Dr. N. N. Barman and DK Sarma, Department of Microbiology
- Assam Valley Wildlife Society (AVWS), a non-profit agency formed by Williamson Magor (WM) and George Williamson (GW) Group of tea companies
- Wildlife Institute of India
    - Mr BC Choudhury
- Centre for Cellular and Molecular Biology
    - Dr Lalji Singh and Sunil K Verma (DNA fingerprinting)
- Zoo Outreach Organisation
    - Ms Sally Walker

- Wildlife Trust of India
    - Dr Anand Ramanathan
- Bombay Natural History Society
    - Dr Vibhu Prakash
- Forest Department, Govt of Assam
    - Mr Srikanta Sarma
    - Director and other officers of Assam State Zoo
- Central Zoo Authority, Ministry of Environment and Forests, Govt. of India

Conservation Breeding and Wildlife Health Training Courses and Workshops

- Wildlife Institute of India
    - Endangered Animal Management Courses for Zoo Directors and senior zoo staff from different zoos in India and other south Asian countries (1-2 courses annually, 20 participants per course)
    - Wildlife Diploma Courses for forest officials from India and other south Asian countries (annual lecture for 25 participants)
    - Post Graduate (MSc) courses in wildlife (annual lecture for 6-8 students)
- Central Zoo Authority
    - Zoo Keepers' Training Courses for North-Eastern India at Assam State Zoo (annual course, 25 participants)
    - Workshops on Health and Management of Zoo Animals for Zoo Veterinarians at College of Veterinary Science (held only once for 100 participants)
    - Zoo Animal Management Courses and Workshops (also organized by WII) (annual course, 20-30 participants)
- Wildlife Trust of India
    - Wildlife Rehabilitation and Disease Investigation Workshops (held only once for 20 veterinarians)

Conservation Education

- Local NGOs (invitation talks, advisory meetings, once a month, 6-12 participants)
    - Conservation Awareness Initiative in Manas, a collaborative effort initiated by PHCP with help of some local NGOs:
        - EcoSystems-India
        - Aaranyak, Guwahati
        - Green Manas, Bansbari
        - Centre for Environment Education - North East, Guwahati
        - Green Hearts Nature Club, Kokrajhar
        - Manas Bandhu Group, Bansbari
        - Rhino Foundation for Nature Conservation, Guwahati
        - TERI-North East, Guwahati
    - Refresher Courses for College and School Teachers (guest lecture, once a month, 15 teachers from 10-15 schools/colleges)
        - Zoology Department, Gauhati University
        - Aaranyak
        - Regional Science Centre
        - Asian Elephant Conservation Programme, CEE
- Project Tiger, Manas Tiger Reserve (two events a year, 20-30 stakeholders per event)
    - Awareness workshops for stakeholders (people, staff, NGOs, etc.)
        - Interpretation Centre, Research and Conservation Education Section

- Training Institutes for Forest Officials (guest lectures, five times per year, 10-20 trainees per session)
    - Assam Administrative Staff College
        - Refreshers courses for Indian Forest Service officers
    - State Forest Service College, Burnihat
        - Rangers' Training Courses
        - Refreshers Course
    - Assam Forest School, Makum and Rangers' College, Jalukbari
        - Trainee Foresters and Forest Guards
    - Assam Forest Protection Force HQ, Basistha
        - AFPF Personnel training
- Local Educational Institutions (8-10 talks per year, 10-12 colleges/schools, 20-40 students per talk)
    - Zoology Department, Gauhati University
        - For graduate students
    - College of Veterinary Science, AAU Guwahati and CAU Aizawl
        - For undergraduate and graduate students
    - Other colleges of Assam
        - Barpeta-Howli College
        - Bongaigaon Science College
        - Mangaldai College
        - Darrang College, Tezpur
        - North Lakhimpur College
        - Cotton College, Guwahati
        - Arya Vidyapeeth College, Guwahati
    - Some schools in Guwahati and Barpeta District
- Other Local Organisations (advisory meetings/discussions, 1-2 time a year)
    - Regional Science Centre Rhino
    - Rhino Foundation for Nature Conservation
    - Assam Science Technology and Environment Council (ASTEC)
    - WWF-India, Assam State Office
    - Voluntary Health Association of Assam
    - Assam Science Society
    - National Youth Camp, Assam Chapter

General Wildlife Conservation in Northeast India (meetings/discussions 3-5 time a year, 3-6 wildlife biologists/conservationists, fieldworkers, scientists, etc.)

- Bombay Natural History Society, also a BirdLife partner in India
- Wildlife Institute of India, also the UNESCO World Heritage Site Programme
- Ashoka Trust for Research in Ecology and Environment (ATREE)
- Kalpvriksh, and most NGOs named above.

Publications

A range of articles in scientific, technical and popular publications has been produced and is listed in Box 4.

Box 4. Publications arising out of DW-supported work on pygmy hogs, 1971-2003

In press

Sarma, M, Devchoudhury, KB, Chakraborty, A and Deka, PJ (in press) Anatomical study on the liver of an adult pygmy hog (*Sus salvanius*). *Indian Journal of Animal Sciences.*

Sarma, M, Devchoudhury, KB, Chakraborty, A, Deka, PJ and Sarma, KK (in press) Biometry of female genital organ of adult pygmy hog (*Sus salvanius). Indian Journal of Animal Sciences.*

Sarma, M, Devchoudhury, KB, Chakraborty, A, Deka, PJ and Sarma, KK (in press) Gross morphology of the liver of sub-adult pygmy hog (*Sus salvanius*). *Indian Veterinary Journal* 80(3).

Narayan, G and Oliver, WLR (in press) Pygmy Hog *Sus salvaniu*. In: *Mammals of South Asia,* Johnsingh, AJT *et al*., eds. Permanent Black, New Delhi.

Rahman, H, Deka, PJ, Chakraborty, A, and Narayan, G (in press) An outbreak of *Salmonella choleraesuis* infection in pygmy hogs (*Sus salvanius*). *Indian Journal of Animal Science*.

2001

Narayan, G and Deka, P J (2001a) *Pigmy Hog Conservation Programme: Interim Progress Report (December 2001)*. 9 pp + Appendix 14 pp.

Narayan, G and Deka, PJ (2001b) Pygmy Hog Conservation Programme in Assam, India. *Asian Wild Pig News*, September 2001 (online pub).

Narayan, G, Oliver, WLR and Deka, PJ (2001) *Pigmy Hog Conservation Programme: Summarised Progress Report (1995-2001)*. 14 pp.

Rahman, H, Chakraborty, A. Deka, PJ, Narayan, G, and Prager, R (2001) An outbreak of *Salmonella enteritides* infection in pygmy hogs (*Sus salvanius*). *Tropical Animal Health and Production,* 33: 95-102.

Sarma, K., Sarma, M, Deka, P. J., Chakraborty, A. (2001) Gross anatomical observation on the tongue of pygmy hog (*Sus salvanius*). *Indian Journal of Animal Sciences* 71(6): 533.

2000

Narayan, G (2000) Reintroduction - principles and protocol, Pigmy Hog Conservation Programme - a case study. *Compendium of Workshop on Health and Management of Zoo Animals for Zoo Veterinarians*, 28-30 October 1999, Guwahati, College of Veterinary Science, Assam Agricultural Univ.

Oliver, WLR, Taber, A, d'Huart, J.-P. and Lewison, R (2000) Pigs, Peccaries and Hippos Specialist Group: Triennial report. *Species, SSC Newsletter* 34: 79-80.

1999

Chakraborty, A, Rahman, H, Deka, PJ and Narayan, G (1999) Outbreak of mixed infection of *Salmonella eneteritidis* and Mucormycosis in pigmy hogs (*Sus salvanius*): *Compendium of the National Symposium on Topics of Current Interest in Pathology of Animal and Poultry Diseases – the Millennium Approach.* Proceedings of the XVI Annual Conference of Indian Association of Veterinary Pathologists, 25–27 November 1999, Bangalore, India, pp. 137.

Narayan, G (1999) Conservation breeding of pigmy hog. *Darwin News: Newsletter of the Centre for Environment Education, Ahmedabad*, 2 pp.

Narayan, G, Oliver, WLR and Deka, PJ (1999) The status and conservation for the pygmy hog (*Sus salvanius*). In *Seventh World Conference on Breeding Endangered Species: Linking Zoo and Field Research to Advance Conservation*, Roth, TL, Swanson, WF and Blattman, LK (eds). Cincinnati Zoo and Botanical Garden, Cincinnati, pp. 109-127.

Narayan, G, Oliver, WLR and Deka, PJ (1999) *Pigmy Hog Conservation Programme: Consolidated Report for Phase I (1995-1998)*. 58 pp.

Narayan, G, , Deka, PJ, Chakrobarty, A and Oliver, WLR (1999) Increase in the captive population of pygmy hogs *Sus salvanius*: Health problems and husbandry. *Dodo* 35: 70-86.

Rahman, H, Chakraborty, A, Deka, PJ and Narayan, G (1999) Virulent determinants of *Salmonella enteritides* associated with an outbreak of Salmonellosis in pigmy hog (*Sus salvanius*). *Souvenir and Compendium of VI Annual Convention of Indian Society for Veterinary Immunology & Biotechnology (ISVIB) & National Symposium on New Biosciences in Animal Resource Developmen*t, 4-6 February 1999, Calcutta, India, pp. C-14.

1998

Narayan, G (1998) Saving the pigmy hog from extinction. *The Rhino Foundation for Nature in NE India – Newsletter* 2(1): 14-17.

Narayan, G (1998) Pigmy Hog Conservation Programme - A case study. *Zoo's Print* 12(10): 2-3.

Narayan, G, Deka, PJ and Oliver, WLR (1998) *The Pigmy Hog Conservation Programme - Third Annual Report*. 43 pp + appendices 15 pp.

Oliver, WLR (1998) More and more and fewer and fewer: Pigs, Peccaries and Hippos Specialist Group report. *Species, SSC Newsletter* 30: 57-58.

Oliver, WLR, Narayan, G and Deka, PJ (1998) The Pigmy Hog (*Sus salvanius*) Conservation Programme: a report on progress to 31st August 1998. *Proceedings of the 53rd Annual Conference of the World Zoo Organisation* 98: 55-71.

1997

Anon. (1997) Hog, hoglets and more hoglets. *On the Edge – JWPT Newsletter* 80.

Oliver, WLR (1997) First catch your hogs. *BBC Wildlife* 15(9): 74-78.

Oliver, WLR (1997) Conservation: Pigmy Hog update. *International Zoo News* 44(6): 351-355.

Oliver, WLR, Narayan, G and Raj, M (1997a) The Pigmy Hog *Sus salvanius* Conservation Programme: Background description and report on progress to end December 1996. *Dodo, Journal of the Wildlife Preservation Trusts* 33: 45-71.

Oliver, WLR, Narayan, G. and Raj, M (1997b) *The Pigmy Hog Conservation Programme-Second Annual Report*. 33 pp.

1996

Mallinson, JJC (1996) The development of cooperative partnerships in support of in situ conservation programmes. *International Zoo News*. 43(5): 389-399.

Narayan, G and Rosalind, L (1996) Bengal Florican. *Preserve - Newsletter of Assam Valley Wildlife Society*: 4-8.

Narayan, G, Deka, PJ, Chakraborty, A and Oliver, WLR (1996) Increase in captive population of pygmy hogs *Sus salvanius*: health problems and husbandry. *Dodo, J. Jersey Wildlife Preservation Trusts*, 35: 70-86.

Oliver, WLR (1996) Catching pigmy hogs in Manas - in only half the time. *On the Edge – JWPT Newsletter* 77.

Oliver, WLR (1996) Biodiversity and conservation in North-Eastern India. *Preserve - Newsletter of Assam Valley Wildlife Society*.

Oliver, WLR (1996) Recovery programme for pigmy hog. *Oryx* 30(4): 232-234.
Oliver, WLR (1996) Conservation: Recovery programme for pygmy hog. *International Zoo News* 43(7): 513-515.
Oliver, WLR and d'Huart, J-P (1996) Pigs and Peccaries Specialist Group: Pigmy hog (*Sus salvanius*) conservation programme. *Species*: *Newsletter of the Species Survival Commission, IUCN* 26-27.
Oliver, WLR and Narayan, G (1996) *Pigmy Hog Conservation Programme – 1st Ann. Report*.24 pp.
Oliver, WLR and Narayan, G (1996) Pigmy Hog Conservation Programme. *Zoo's Print* 11(11): 21-25.
Oliver, WLR, Narayan, G and Raj, M (1996) *Report on Capture Operation in Manas - Acquisition of a Founder Breeding Stock and Initiation of Radio-telemetry Studies*. Pigmy Hog Conservation Programme. Mimeograph report. 23 pp

1995

Oliver, WLR (1995) Taxonomy and conservation status of the Suiformes - an overview. In: *Proceedings of the 2nd International Symposium on Wild Boar and Sub-order Suiformes; Ibex, Journal of Mountain Ecology No.3*, Autumn 1995: 3-5.

1993

Blouch, RA and Oliver, WLR (1993) Review of priorities for conservation action and future research on South and Southeast Asian suids: In *Pigs, Peccaries and Hippos: Status Survey and Conservation Action Plan*, Oliver, WLR (ed.). IUCN, Gland, pp. 191-195.
Oliver, WLR (ed.) (1993) *Pigs, Peccaries and Hippos: Status Survey and Conservation Action Plan*. IUCN, Gland, 202 pp.
Oliver, WLR and Deb Roy, S (1993) The pygmy hog (*Sus salvanius*). In *Pigs, Peccaries and Hippos: Status Survey and Conservation Action Plan*, Oliver, WLR (ed.). IUCN, Gland, pp. 121-129.

1992

Bell, DJ and Oliver, WLR (1992) Northern Indian tall grasslands: management and species conservation with special reference to fire. In *Tropical Ecosystems: Ecology and Management*, Singh, KP and Singh, JS (eds). Wiley Eastern Ltd., New Delhi, pp. 109-123.

1991

Oliver, WLR (1991) A review of the status of sanctuaries for the pigmy hog, *Sus salvanius*: A report on a visit to NW Assam in February, 1990. *Dodo, Journal of the Jersey Wildlife Preservation Trust* 27: 62-70.
Oliver, WLR (1991) Monograph on the pigmy hog, *Sus salvanius*. In *Proceedings of the Pigs and Peccaries Workshop at Zoo Berlin*, Fraedrich, H and Klos, H-G (eds), 12-15th July 1990, *Bongo*, Berlin: 21-38.

1990

Bell, DJ, Oliver, WLR and Ghose, RK (1990) The hispid hare, *Caprolagus hispidus*. In *Rabbits, Hares and Pikas - Status Survey and Conservation Action Plan*, Chapman, JA and Flux, JEC (eds). IUCN, Gland, pp. 128-136.
Oliver, WLR (1990) *A Reprieve for Barnadi*. Unpubl. report to IUCN, 3pp.
Oliver, WLR: *The Troubles in Manas*. Unpubl. report to IUCN, 5pp.
Pandya, NP (1990) *Report on an Initial Survey of Pigmy Hog,* Sus salvanius*, and Hispid Hare,* Caprolagus hispidus*, and their Habitat in Arunachal Pradesh, India during April 1990*. 25pp.

1989

Oliver, WLR (1989) The pigmy hog and hispid hare: case histories of conservation problems and related considerations in north-eastern India. In *The Conservation of the Indian Heritage,* Allchin, B, Allchin, ER and Thapar, BK (eds). Cosmo Press, New Delhi, pp. 67-82.

1987

Oliver, WLR (1987) *Comments and Recommendations on the Master Plan and the Future Redevelopment of the National Zoological Park, New Delhi*. (Unpubl. report to the Ministry of Environment, Govt. of India, 18 pp.

1985

Anon. (1985) Choosing the 24 most endangered species. *Newsletter, Species Survival Commission* 5: 17-23.

Oliver, WLR (1985) *The Distribution and Status of the Hispid Hare,* Caprolagus hispidus *- with some Additional Notes on the Pigmy Hog,* Sus salvanius*: A report on the 1984 Field Survey in Northern Bangladesh, Southern Nepal and Northern India*. Report to Jersey Wildlife Preservation Trust, 96 pp.

1984

Oliver, WLR (1984) The distribution and status of the hispid hare, *Caprolagus hispidus*: the summarised findings of the 1984 pigmy hog/hispid hare field survey in northern Bangladesh, southern Nepal and northern India. *Dodo, Journal of the Jersey Wildlife Preservation Trust* 21: 6-32.

1983

Bosma, AA, Macdonald, AA and Oliver, WLR (1983) The karyotype, including G- and C-banding patterns of the pigmy hog, *Sus (Porcula) salvanius* (Suidae, Mammalia). *Genetica* 61: 99-106.

Wells, SM., Pyle, RM and Collins, NM (1983) Pygmy hog sucking louse, *Haematopinus oliveri* (Mishra and Singh, 1978). *The IUCN Invertebrate Red Data Book.* IUCN, Gland, pp. 365-367.

1981

Oliver, WLR (1981) Pigmy hog and hispid hare - further observations of the continuing decline (or, a lament for Barnadi and a good cause for scepticism). *Dodo, Journal of the Jersey Wildlife Preservation Trust* 18: 10-20.

1980

Oliver, WLR (1980) *The Pigmy Hog - the Biology and Conservation of the Pigmy Hog,* Sus salvanius*, and the Hispid Hare,* Caprolagus hispidus. *Jersey Wildlife Preservation Trust, Special Scientific Report No. 1,* 120 pp.

1979

Oliver, WLR (1979) Observations of the biology of the pigmy hog (with a footnote on the hispid hare): pigmy hog survey report, part II. *Journal of the Bombay Natural History Society* 76 (2): 115-142.

Rands, M, Brown, P and Newton, P (1979) *University of East Anglia Nepal Expedition, 1978/1978,* 79pp.

1978

Oliver, WLR (1978) The doubtful future of the pigmy hog and the hispid hare: pigmy hog survey report, part I. *Journal of the Bombay Natural History Society* 75 (2): 341-372.

Schmitt, CR, Mallinson, JJC and Weilenmann, P (1978) International co-operation for captive breeding of the pigmy hog *Sus salvanius. International Zoo News*.

1977

Mallinson, JJC (1977) Breeding of the pigmy hog, *Sus salvanius* (Hodgson) in northern Assam. *Journal of the Bombay Natural History Society* 74 (2): 288-289.

Mallinson, JJC (1977) Rediscovery of the pigmy hog, *Sus salvanius* (Hodgson) in northern Assam. *Journal of the Bombay Natural History Society* 74 (2): 288-289.
Oliver, WLR (1977) Tracking pigmy hogs in north-western Assam. *JWPT Newsletter* 32.
Oliver, WLR (1977) The continuing decline of the pigmy hog and hispid hare. *Dodo, Journal of the Jersey Wildlife Preservation Trust* 14: 80-85.
1971
Mallinson, JJC (1971) The pigmy hog, *Sus salvanius* (Hodgson) in northern Assam. *Journal of the Bombay Natural History Society* 68 (2): 424-433.

Other outputs of the PHCP

In 2002 the PHCP identified several accomplishments. These are shown in Box 5.

Box 5. Principal accomplishments of the PHCP since 1995

1) Development and implementation of first-ever international conservation management and research agreement with Governments of India and Assam.
2) Conduct of extensive surveys of all recently known and suspected pygmy hog habitats in northeast India; continued monitoring and production of relevant management recommendations in key areas.
3) Capture of 11 wild pygmy hogs without any injury to anyone (except to the beater who grabbed a porcupine trapped in the nets in the mistaken belief it was pygmy hog!).
4) Design and development of a custom-built pygmy hog breeding centre and associated facilities.
5) Development of scientifically based husbandry and veterinary protocols of proven efficacy.
6) Highly successful captive reproduction (i.e. 12 fold increase in captive stock in 6 years, despite enforcement of management procedures to reduce recruitment levels during past 3 years) of the world's only captive population of this species, comprising 70 (35.37) individuals (at 31 Dec. 2002) and perhaps as much as 10-20% of the total world population of this species - all of which is in marked contrast to previous abysmal captive breeding, survivorship and longevity records in Assam and elsewhere.
7) Successful investigation and prevention of diverse infectious diseases in collaboration with the College of Veterinary Science, and capacity building among the consultants from the College.
8) Development of model conservation breeding programme in India, attracting regular visits by wildlife students, trainees and decision makers to the breeding centre and leading to PHCP personnel being frequently invited as resource speakers by premier national agencies such as the Wildlife Institute of India and the Central Zoo Authority.
9) Conduct of radio telemetry studies on wild hogs in Manas
10) Development of grassland ecology and management research in Manas and elsewhere.
11) Conservation awareness programmes in the fringe villages of Manas.
12) Initiation of the DNA fingerprinting studies on pygmy hog for the first time.
13) Generation of enormous goodwill and publicity for the Durrell Wildlife Conservation Trust in India.

(from *Pygmy Hog Conservation Programme Background Notes for Strategic Planning Meeting, Durrell Wildlife Conservation Trust, 10-11th July 2002*)

Costings

Table 2 presents the last 10 years (1993 to 2002) financial information on expenditure on the project. During the first five years the project was wholly funded externally (through grants and fund raising) and in the last five years the Trust has raised the income to cover 70% of project costs.

Table 2. Expenditure and income on the pygmy hog conservation programme 1993-2002

Year	**Expenditure (£)**	**Income received (£)**	**Paid by Trust (Overseas Fund, £)**	**Comments**
2003	53,718			Budgeted, made up of £43,718 existing recurrent and £10,000 restricted to be sought
2002	53,725	40,655	13,070	Expenditure includes money owed to project from 2001
2001	28,646	8,976	19,670	
2000	34,436	21,872	12,564	
1999	43,297	36,718	6,579	
1998	37,593	30,572	7,021	
1997	39,130	39,130	0	EU funding (1997-98)
1996	62,224	62,224	0	EU funding (1996-97)
1995	46,172	46,172	0	EU funding (1995-96)
1994	8,139	8,139	0	
1993	1,318	1,318	0	
Total (93-02)	**354,680**	**295,776**	**58,904**	

Efforts are already underway to secure restricted funding towards workshops costs (see Appendix 3.)

Appendix 1. Notes on pygmy hog meeting, held at Durrell Wildlife Conservation Trust Jersey, 11th July 2002.

Present:	Mark Stanley Price	
	John Hartley	
	Quentin Bloxam	
	Tony Allchurch	
	John Fa	
	Anna Feistner	
	Maggie Esson	
	William Oliver	Director, Pygmy Hog Cons. Prog.
	Goutam Narayan	Project Manager
	Parag Deka	Project Officer/Veterinarian

MSP had given a presentation to WO, GN and PD about the Trust's new strategy on the 10th July.

This is a long running project and future decisions on where it is going must be cost effective.

1. Summary

Critically endangered species. There is only one known surviving wild population in Manas National Park (MNP). Highly threatened area with high number of other critically endangered species. Very important wildlife area in the Indian sub-continent

Part of the MNP has been taken over by insurgents, mostly members of the Bodo tribal community, and the future of the Park is therefore threatened. Pygmy hog population disappearing due to bad management habit and inadequate protection, i.e. burning of grassland by Park officials and local people. Alternative methods of management are expensive and Assam Forest Department is effectively bankrupt.

The early burning of the grassland damages the habitat by reducing biodiversity and leaving the animals without shelter or other resources during critical dry season periods. Fifty percent of the Park is grassland in an area of 500 km^2. Tribal settlers have encroached on some grassland areas. A survey in 1977 advised that areas would disappear and this has occurred.

Pygmy hogs are mainly isolated in areas along southern boundary of the Park and probably number less than 500. The animals have a small home range and there are no areas left for animals to escape the burning. Larger animals leave the area when burning takes place. Hispid hare can survive on river banks during the critical period but such areas are of no use to the pygmy hog as they depend on certain species of grasses and tubers.

Early problems caused by the Trust having to get permission from two Governments to carry out work – Government of India and Government of Assam. North-eastern region is politically sensitive and frontline states had been temporarily invaded by China in the 1960s. Pygmy hog is seen by the Assamese authorities as belonging only to the state.

Unable to use satellites to obtain good maps of the area due to "paranoia" on behalf of Indian Government of such use. The area has been surveyed adequately by other means. Satellite

pictures are available showing nearby areas such as Bangladesh which may overlap into Assam. The expense in obtaining copies of such pictures cannot be justified. Satellite pictures of Bhutan would be very useful.

Ecotourism is much reduced in the State and virtually non-existent in Manas. Some visitors used to go to Manas for fishing but this has now been banned, and the Park closed at frequent intervals owing to political unrest. The Bodo extremists, big game poachers and timber smugglers have also burned boats, bridges and destroyed some other facilities in the Park. It is also difficult to see wildlife in Manas and access is mainly by elephant. Kaziranga National Park, on the south bank of the Brahmaputra is a preferred destination for eco-tourists, since the area is generally far safer and it is easier to see wildlife in the Park, though Kaziranga protects fewer Schedule One animals than Manas.

There is currently a good relationship with the State Government and Central Government. People are changing their views after seeing work carried out at the pygmy hog breeding centre.

The two governments are trying to solve the security problem by setting up a Bodo Territorial Councils to govern the region where Manas is located. This will be helpful to the conservation programme and local people will benefit.

Captive population highly vulnerable. Good progress made in first few years but programme now needs to be developed. Unable to accommodate any more animals in the existing area, so breeding has had to be strictly controlled and limited. Therefore need to extend facilities – both to enable reproductive management, spread the risk, prepare animals for reintroduction projects and, consequently put animals back into the wild. However, also need governmental support in protecting habitat by providing security guards, control burning (etc.) and staff to monitor reintroduced stocks. The Forest Department must help. Present work is carried out under permit and permits need to be issued when something new needs to be set up. Current Forest Department staff are helpful and supportive, but lack resources.

Most of the project staff are Assamese, with some Bodo staff introduced into sensitive areas to establish good relations and explain what is going on.

2. Constraints and opportunities

Good relations also developed with local government and NGO's. Existing agreement gives mandate to do many things.

Other areas need to be found for the reintroduction/release of animals from the captive breeding programme. Setting up another breeding centre is crucial but partly also a stop-gap. Manas is first choice for initiating conservation efforts to save the existing populations. It is a threatened IUCN World Heritage Site and the Bodos are keen to preserve the area. Manas can be used as a research and working area to protect the wild population. Communication with villagers is vital. Impossible to place animals elsewhere in India at present, but hope to do in future. .

Militants have camps on the Bhutan side of Manas National Park and they move through the Park. Security non-existent and therefore poachers take advantage of the situation and poach the larger animals, e.g. rhino, tiger, elephant.

Focus on current situation and look at what can be done in Manas. Use excess animals to benefit conservation work. Need to define what the Trust is trying to do. Security in Manas not under Trust's control. Management of grasslands needed for continued survival of the pigs. Change burning culture in region. Need to implement system of "patch" burning to benefit optimum number of species. Fire lanes are needed to hold back burning and protect pygmy hog habitat. These are expensive and the government could not afford to pay for them. Should Trust funds be used for this? Assam authorities must be satisfied before animals are moved.

ACTION POINT - Sites must be managed in conjunction with Forest Department for the benefit of the pygmy hog.

The Trust can now negotiate from a position of strength with government personnel. Strategic issues needed to meet with Ranjit Barthakur over the coming weekend (Indian businessman with many influential contacts). List of potential sites within Assam to be prepared.

Prevent extinction of pygmy hog and maintain surviving pigs in viable numbers. Up to 50 animals could be produced per year for reintroduction. Enhance survival of the species. Good management of reintroduced areas would help other species.

Conversely, a single catastrophe (e.g. disease, human encroachment of remaining grasslands, etc.) could wipe out the only existing wild population. Pygmy hog is a very good indicator of the health of the grassland habitat also used by other species. Presently there is an enormous loss of biodiversity due to bad management of habit. Pygmy hogs inhabit secondary successional grasslands. They are very secretive animal requiring dense cover, but can return to burnt areas as soon as there is sufficient cover.

This animal is an iconic species to the people in Assam and could therefore be used as a demonstrator. Possible reintroduction sites in Assam are in the narrow foothill belt along state's border with Bhutan and Arunachal Pradesh. Use potential release sites of pygmy hog as reasons for not burning these areas. Other possible sites outside Assam that may be used for future demonstration / reintroduction are in southern Arunachal Pradesh, northern West Bengal and northern Uttar Pradesh.

Research needed on other consequences. Density study should be made.

3. Review of existing PHSRP activities

Focus is on a critically threatened endemic with small population living in specialised habitat. Species needs conservation management.

Research and publication of work done by the pygmy hog programme is needed. Assess current management practices in Manas and improve on these. Data gathering has been done on the captive breeding programme and a reporting system has been set up. CBP lacks behavioural study also needs investigation into disease and prevention. Grassland study has been going on for one year so it will be some time before data is available on this. ARKs system had problems due to frequent breakdown of electric supply and consequently of the ~~so~~ computer systems.

Capacity development is carried out by talking to local people, contacts with local veterinary college, university departments, and wildlife and forestry schools. Conservation awareness with local administrative college and forestry schools who visit the centre and learn about the work. Direct involvement with forestry staff in programme. Park staff is also involved in ecological studies of grassland.

Conservation impact can be done by taking over responsibility from the Government authorities and passing this on to groups with more skills and resources. This would create a precedent. Written protocols are in place but ethical guidelines are not. Protocols are continuously reviewed.

4. Objectives/activities

1) To ensure the survival of the pygmy hog into perpetuity by promotion/implementation of agreed priority activities including:- Monitoring of existing wild populations and facilitation of relevant Management interventions

a) Field survey/development of conservation management plans for any other possibly existing wild population or potential future release sites.

b) Reinforcements of existing captive stock through accession of additional founders and establishment of satellite breeding stocks elsewhere.

c) Initiate trial release in selected areas including pre and post release activities.

2) To promote/assist enhanced future protection and management of Manas National Park and its buffer reserves (= Manas Tiger Reserve).

3) Facilitate and enhance understanding of the species and its keystone role for enhanced future management of biodiversity in early successional tall grass ecosystems in the Northern Indian sub-continent through:-

a) conduct of more applied scientific research

b) conduct of relevant local public/decision-makers awareness programmes and activities

c) personnel training.

A paper was circulated to attendees entitled “Pygmy Hog Conservation Programme – Preliminary Action Plan for Phase II”. It was explained that this was a refinement of the objectives produced at the inaugural meeting of the Governing Body of the Programme in India including the above objectives and action points.

The main concern was the survival of the pygmy hog into perpetuity. To this end it was decided to:

1) Monitor the wild population and facilitate an enhanced understanding and appreciation of this species and it potential importance as a keystone species and genetic resource.
2) Carry out field surveys.
3) Reinforce existing stock at breeding centres.
4) Carry out trial releases.

The time frame for these objectives depends on when permissions are received from the authorities and finding the correct staff. Local students could not carry out such work as they do not have enough time and expertise. Outside research personnel could be used and would have many advantages. Trust could help with this. However such personnel would not spend

long periods in these military sensitive areas but they could head-start radio tracking and monitoring and then whereabouts of animals could be checked periodically.

DNA studies on hair and blood samples are continuing and it is fairly certain that the founder population are related. Problem is whether to bring in new animals. DNA samples and health screening would have to be carried out on such animals. DNA information is very sensitive and all samples are taken to a government laboratory.

Construction of second centre, which includes four large pre-release enclosures, is very expensive and the figures submitted do not include running costs. However the captive-bred population must be split between two sites which is better than one and there could be greater genetic diversity by bringing in more founders with the same number of hogs. Reproductive potential of the captive hogs are not being utilised fully due to lack of space at the present centre and only one female out of twenty-two odd was allowed to breed this year. The second centre could be constructed less cheaply and have different management structures put in place, with greater emphasis on the pre-release or halfway house for animals to be released in the wild. All release options and the question of restoration and adequate protection in the release sites would have to be discussed with the government authorities.

It is vital that animals be moved away from the present captive-breeding centre. The Trust could talk to the government authorities but there are other organisations involved with this programme such as the Pigs Peccaries and Hippos Specialists Group. Trial releases should be carried out before a larger reintroduction. To go straight into a trial release without using halfway house facilities would seriously diminish the survival prospects of the released animals.

Trial releases could take place in fenced-off areas but these would be destroyed by larger animals such as elephants. The captive-bred pigs released into could wander into villages or agriculture and could be killed by people or dogs. If the villagers learn that the pigs have been released in the area they could go out and capture them for food unless they are made aware about the conservation importance of the species through educational programmes. On the other hand tame animals released into the wild might not stay tame, but teaching them how to find food in the wild, escape from predators and avoid human areas would certainly enhance their chances of survival. Thus animals selected for release would have to be managed in a safe pre-release area to observe their behaviour and they would have to be habituated before release. This could be a large enclosure that will be required only for a fixed period time before release. Release animals would be monitored by radio tracking. A release could take place before constructing the second centre to see how it works. The release option is better than sending animals to the local zoo. Assam State Zoo has agreed to take four hogs.

ACTION POINT: A single trial release should be carried out. Draw up outline for such a trial release.

An area could be used where ‘historically’ the pygmy hog has never lived before. Construct large enclosure possibly on private land for the purpose of tracking a family group for pre-release training. This enclosure could then be recycled for other groups.

If the trial release was disastrous this would not look good from the Programme’s point of view with the government authorities.

There are not enough founders for an adequately heterozygous population. Animals could be moved to European zoos, which would raise large sums of money for the project. Animals could be a showcase species. This could happen if more founders are caught.

The density of pygmy hogs in the wild has been based on extrapolation of capture operation and radio tracking data. Main problem with this was not being able to find enough animals from different sites. It also showed that males were mainly sedentary animals who~~m~~ became territorial in the mating season. It is believed that the present wild population is declining due to ecological disturbance. When capturing founder population 42 animals were actually flushed during 57 drives in a 6 km² area, however, the population density is expected to be higher. Trial release could take place in a one square kilometre area well fenced and extensively managed which would encourage good population. The more animals released the more chance of success. If animals were just released back into Manas without trial releases, some officials would be delighted but the animals would not survive, it would also put wild population at risk from disease.

If the release and dispersal of captive-bred animals are not done on a regular basis the second centre too could become log-jammed with animals if a large number of animals are produced. Serious implications with a large number of animals living together.

It is vital that animals from the captive breeding centre are dispersed. There are problems in sending animals to other zoos in India. The largest hurdle with the Assam authorities would be moving animals out the State. Four founders have died and the existing animals are now genetically viable and should <u>not</u> be regarded as "surplus". Population model and risk analysis could be carried out by Phil Miller. A CAMP would involve other *Suid* specialists and be held in Assam. A PHVA would raise the profile of the animal and be attended by all the *Suid* experts in the world, but it would be very expensive. This would, however, be seen by the Assam authorities as an 'international' gathering. The Programme already has some enemies in higher governmental positions, due to its success (with outside help) as opposed to their own action plan for the animal which failed. However a PHVA would bring in fresh ideas, or reinforce existing ones.

Another option was that the Trust could offer to pay for a fire managed regime. Unfortunately any funds sent for such a project would go into the main coffers and not be received for the work to be carried out in Manas.

5. Outcome

Concrete recommendations needed and a logistical framework required. Systematic assessment on reintroduction sites needed to address areas of research. A survey of the grasslands could be carried out on the lines of study by Nick Peet who has carried out previous studies in similar grassland areas of Nepal. He can be contacted for more information. Situation with current stock is desperate and efforts to initiate trail release and establishment of one or more captive population must be initiated urgently. Remaining wild population also needs to be looked at to ensure its continued survival. Outline of disposal plan required. Agreement needed from government authorities to move animals out of Assam. These would relieve current overcrowding although present animals are not expensive to keep.

In order to implement any new actions it would be advisable to go “through the back door” to the authorities and have talks and make suggestions which they would then put into their own action plan. Government personnel keep changing which does not help the situation. An action plan from the Pygmy Hog Conservation Programme would not necessarily receive approval. There is continual contact with the Director of Manas National Park and this is very encouraging.

As the second centre is not referred to as a “breeding centre”, it can be used for any purposes such as halfway house etc.

John Hartley thanked everyone for their contributions.

The meeting closed at 5.15 pm.

Appendix 2. DW Operational Plans for PHCP October 2002 (summarised)

Who else would be involved?
Govt of Assam, Govt of India, IUCN/SSC Pigs Peccaries & Hippos Specialist Group, local consultants in India, National Park personnel, DW

Objective 1
Maintain a viable population of captive pygmy hogs which can act as a source for future re-establishment

Category
A. Critical to achieve Strategic Framework objectives

Cross-reference to Strategic Framework
Strategy 1 conservation, objective 2

Activities
- Continue to manage and breed the captive hogs at Basistha, with the aim of establishing a heterozygous population of healthy captives for future release programmes
- Develop and implement behavioural and environmental management strategies in captivity to improve hogs' chances of survival in the wild when released (2004)
- Train staff from Assam State Zoo in pygmy hog captive management
- Agree and implement protocols for useful dispersal of selected surplus individuals to other breeding centres, initially at Assam State Zoo
- Develop a plan to increase genetic variability by further imports from Manas
- Review and agree scope and location of second facility
- Prepare and submit project funding proposals for development of second facility

Results/outputs
- Greatly enhanced heterozygosity, and hence likely genetic viability, of sole founder breeding population
- Implement minimal intervention, pre-release management strategies in second facility (2004)
- New conservation management techniques are learnt / perfected (2004)
- Staff at Assam State Zoo are capable of pygmy hog husbandry (Note that pygmy hogs from ASZ will not be used in SRP)
- Assam State Zoo becomes a collaborator in the PHCP
- Implementation of the agreed management plan recommendations, as signified and agreed in the covering MOU (Phase 2) with Governments of India and Assam (2004)
- A proposal and budget for the second facility submitted to various potential donors

Outcomes/impacts
- Trial reintroduction of surplus, multi-generation, captive-bred individuals in socially cohesive groups, reared under minimal management intervention conditions (2004)
- Development of new optimal minimal management protocol (2004)
- Satellite populations established at Assam State Zoo and other selected/agreed breeding centres and receive appropriate care and husbandry
- Establishment of cooperative management protocols that can be adopted for use for any future dispersal of pygmy hogs to other (government accredited) facilities

- The heterozygosity of the captive population can be increased by imports of wild-caught hogs from Manas when circumstances are appropriate
- Scope and nature of the second facility is clear and facility is funded

Schedule in 2003, or into 2004
All above for 2003, except where marked 2004

Objective 2
To investigate and assess grassland habitat management options to support pygmy hogs and other endemic species consistent with human use and to identify to other rare, endemic and threatened fauna in the region as future DW iconic community

Category
A. Critical to achieve Strategic Framework objectives

Cross-reference to Strategic Framework
Strategy 1 conservation, objective 2

Activities
- Continue research and monitoring of grasslands in Manas and other sites in Assam to determine the impact of current management practices on fauna and flora
- Collaborate with site personnel and local people to gather information and raise awareness about grassland management-related biodiversity conservation issues
- Review the status of other rare, endemic and threatened fauna in the region and make recommendations for possible DW conservation action

Results/ouputs
- Greater understanding of the impact of burning and human use on the early successional alluvial grassland communities that are species-rich, critically threatened and are often mismanaged
- Information on which to develop a grassland management plan for conservation of endemic, threatened grassland-dependent species
- Local population supports and participates in grassland conservation initiatives of the PHCP
- Identification of early successional alluvial grassland faunal community with recommendations for DW conservation initiatives

Outcomes/impacts
- A grassland management plan is devised and implemented with local support
- Protected areas personnel and local people are aware and supportive of pygmy hog conservation requirements
- Local capacity for resource management and monitoring is increased
- Improved habitat management reduces extinction risks for pygmy hogs and associated threatened fauna
- Identification of an iconic community for possible future DW conservation intervention

Schedule in 2003, or into 2004
All the above in 2003

Objective 3
Prepare, agree and initiate implementation of plans for trial release of captive-bred pygmy hogs (to include technical, logistical, financial and political aspects)

Category
A. Critical to achieve Strategic Framework objectives

Cross-reference to Strategic Framework
Strategy 1 conservation, objective 2

Activities
- Hold consultation workshops and meetings in India for initiating preparations for trial release and to discuss other options for the Species Recovery Programme
- Develop selection criteria for potential release sites for pygmy hogs
- Use criteria to select two sites for development (for trial release in one of them)
- Agree the nature and scope of pre-release facilities
- Undertake awareness generation and capacity building among local protection (Forest Department) staff and local people using workshops
- Undertake rapid socio-economic survey in villages close to release area

Results/outputs
- Consultation workshop to discuss and develop the need, scope and modalities of the planned trial release exercise
- Selection of a trial release site and an alternate ('plan B') site
- Local protection staff prepared to participate in habitat restoration efforts and future trial release
- Greater understanding of local socio-economic issues in communities neighbouring agreed release site
- Human population neighbouring the trial release site participates in awareness workshops
- Habitat restoration initiatives undertaken in the grasslands of the identified trial release sites (including cutting of fire lines and clearing of natural drains for prevention of accidental burning and flooding; protection against livestock grazing, thatch collection and other commercial exploitation)
- Proposal is prepared for preparation of pre-release holding facilities (detailed specifications, costing, and planning)
- Proposal for pygmy hog reintroduction is sent to IUCN/RSG
- Funding proposals for pygmy hog trial release are produced

Outcomes/impacts
- The concept and plan for trial release has support of Indian and local government as well as local Forestry Dept staff and local people
- Increased local capacity for resource management and conservation
- A detailed plan is submitted to the RSG
- Proposals for funding of trial release are submitted
- The interface between Basistha, any second holding facility and pre-release facilities are clear and can be separately funded for
- Preparations are in place for trial release in 2004
- Management of the release site benefits existing fauna

Schedule in 2003, or into 2004
Consultation workshop in Jan. or Feb. 2003
Short-listing of potential release sites and identification of two sites in Jan.-Feb. 2003
Rapid socio-economic survey in some key fringe villages close to the two identified trial release sites in Mar.-Apr. 2003; data analysis and workshops preparations May-Jun. 2003
Awareness generation workshops for local villagers Oct.-Dec.2003
Capacity building / habitat restoration workshops for local protection staff Oct.-Dec.2003
Construction of pre-release facilities 2004

Objective 4
To ensure that the PHCP has the managerial, financial and logistical capacity to achieve its objectives, often working with strategic partnerships and maintaining a strong integration with the rest of the Trust

Category
B. Critical for keeping essential services going

Cross-reference to strategic framework
Strategy 3 Organisational Development, Objective 3
Support strategy 4 Administration and operations, Objective 1

Activities
- Produce funding proposals and reports in collaboration with DW Jersey
- Initiate exchange of staff/expertise with DW Jersey
- Hold annual meetings to review strategic planning and progress of the PHCP in Assam and Jersey

Results/outputs
- Financial resources to achieve objectives are secured
- Annual progress and planning reports produced

Outcomes/impacts
- Sufficient financial resources to support planned conservation activities
- Improved use of resources
- Broader access to other conservation work
- Improved planning and evaluation allowing adaptive management of conservation projects
- PHCP/DW makes an effective contribution to conservation of endangered endemic species in Assam

Appendix 3. Chronology of Events
(from *Pygmy Hog Conservation Programme Background Notes for Strategic Planning Meeting, Durrell Wildlife Conservation Trust, 10-11th July 2002*)

1847-1970: The species was described in 1847. Subsequent accounts are rare and mostly anecdotal, since the species is a highly inconspicuous inhabitant of early successional, tall, dense grasslands characteristic of alluvial floodplains along the southern (formerly largely inaccessible) Himalayan foothills. Absence of any reports in mid-20th century led some authors in the early 1960s to suspect the species' probable extinction (notably Gee 1964).

1971: Its 'rediscovery' was announced in late March 1971, following captures of at least 14 individuals which had sought refuge in a tea estate following an extensive fire in the neighbouring Barnadi Reserve Forest in Mangaldai, NW Assam; a circumstance made slightly more remarkable by the capture of another, similarly presumed extinct species, the hispid hare (*Caprolagus hispidus*), in the same area, and the coincidental sighting of a wild pigmy hog in Manas Wildlife Sanctuary approximately 70 km west of Barnadi. These events also prompted the attempted establishment of a captive breeding project on a local tea estate, a request to the Trust for technical assistance in the development of this project (hence Jeremy Mallinson's first visit to Assam in 1971), and the creation of the Assam Valley Wildlife Society (AVWS) by a consortium of tea companies owned by the Williamson Magor group to oversee this endeavour (Mallinson 1971; Tessier-Yandell 1971).

1971-1976: Despite numerous births and further accessions of wild hogs, the tea estate breeding project floundered owing to poor understanding of the species' requirements and improper management. Of the few surviving animals at least three (1.2) were donated to Assam State Zoo (this stock died out in c. 1979), one pair were released (introduced) in Orang Wildlife Sanctuary (which disappeared within 1 month of release into a 1 ha 'pre-release' enclosure) and one pair sent on breeding loan to the Trust via Zurich Zoo (which stock died out in Zurich *c.* 1984) (Mallinson 1976; Oliver 1980; Oliver & Deb Roy 1993).

1977: First ever field survey and field study (including radio-telemetry) sponsored by the Trust over 3 month period, revealed dire effects of dry-season burning and other threats to this species, its continued presence in Barnadi, Manas and at least six other forest reserves, but also its extirpation from at least two other sites as a result of too extensive burning and other commercial forestry operations. Various recommendations for the enhanced future conservation of this species and its habitat were agreed with relevant state government authorities for immediate implementation (Oliver 1978, 1979, 1980).

1978-79: University of East Anglia Expedition and other privately sponsored surveys fail to locate any surviving hog populations in the few remaining tall grasslands of south-central and south-east Nepal (Griffith 1978; Rands *et al*. 1979). Last surviving captive animals in tea estates and Assam State Zoo die out.

1980: Publication of monograph on the pygmy hog and hispid hare as the Trust's 1st Special Scientific Report (Oliver, 1980).

1981: IUCN/SSC Pigs & Peccaries Specialist Group established; it convenes its inaugural meeting in New Delhi with Trust support. Barnadi Reserve Forest upgraded to a Wildlife Sanctuary by the government in response to the 1997 survey findings, but return visit to Assam by PPHSG/DW representative reveals drastic deterioration in protection of this area.

No action had been taken by relevant state government authorities to implement any of the previously agreed conservation management recommendations in Barnadi and other areas. On the contrary, continued (mostly illegal) human encroachments and other factors had resulted in the extirpation of at least one, but possibly two or more, of the few known remnant populations in other reserve forests in the NW Assam forest belt. Rumours of the possible occurrence in this species in northern Uttar Pradesh were also investigated, but the only available habitat was found to have been completely inundated during construction of a new dam (Oliver 1981; Oliver and Deb Roy 1993).

1984: Wide-ranging field status survey conducted by the Trust in northern Bangladesh, northern West Bengal, southern Nepal, north-east Uttar Pradesh and central Madhya Pradesh reveals presence of many hitherto unreported populations of hispid hares, but no firm evidence of any surviving pygmy hog population (Oliver 1984, 1985).

1985: PPHSG/DW prepare and submit a 3-point action plan for the conservation of the pygmy hog at the request of the Indian Central Government. Pygmy hog identified by IUCN-WWF as one of the world's 12 most endangered species (Anon. 1985).

1986: Trust-supported follow-up study of hispid hare in Royal Suklaphanta Wildlife Reserve (SW Nepal) yields much new information on the behavioural ecology of this species, but also fails to reveal any firm evidence of the possible survival of pygmy hogs in this area. Manas National Park designated as a World Heritage Site (Bell 1986, 1987; Oliver and Deb Roy 1993).

1987-88: The 3-point Action Plan was finally discussed and approved in New Delhi with PPHSG/DW representative in December 1987, when the then Assam Chief Wildlife Warden was contracted to oversee implementation of recommendations with additional funding support from the union Ministry of Environment and Forest. However, none of the key recommendations were completed or enacted properly (including capture of at least 17 pygmy hogs in Manas for release into a 1.25 ha enclosure in the Park, which proved highly counter-productive), and no report was ever produced.

1989: Manas National Park invaded by extremists, who wrest control of much of the core area from the authorities and enable influx of wildlife and timber poachers. Several forest guards also murdered, patrol boats, buildings, bridges and other property destroyed (Oliver 1990; Oliver and Deb Roy 1993).

1990: Follow-up visit by PPHSG representative sponsored by the Trust results in addition of Manas to IUCN list of threatened protected areas and IUCN resolution urging relevant authorities to regain control of Manas, but no effective action taken by those authorities for various, mostly socio-political (rather than military) reasons. Conversely, protection and habitat management practices in Barnadi improve, but continued survival of the species in the area doubtful.

1991-1994: Spreading civil unrest and other factors undermine restoration efforts in Barnadi, leading to the removal of a responsible officer and intense demoralisation of other local Forest Department staff in this area and in Manas, where the situation remains desperate. Nonetheless, in absence of any confirmed reports in Barnadi for several years, Manas is now believed to support the last known surviving population of this species. Meanwhile, continued networking and advocacy, coupled with eventual changes in senior officials in both the

Assam State Forest Department and Ministry of Environment, effect gradual softening of official attitudes towards proposed formal agreement between these authorities, the PPHSG and DW to enable implementation of pygmy hog conservation and recovery programme. In 1994, following formal notification to this effect, Dr G. Narayan was tentatively selected as PHCP Project Manager and provided with training scholarship at ITC.

1995: A formal 'International Conservation Management and Research Agreement (ICMRA)' for the Pygmy Hog, signed between the Union Ministry of Environment and Forests, Assam Forest Department, DW and PPHSG – the first (and so far only) such agreement ever signed in India. The Trust secures a 3-year grant from the EU and construction work starts on development of the Pygmy Hog Research and Breeding Centre at Basistha, on the outskirts of Guwahati, state capital of Assam. Deputy Project Manager appointed and trained in radio telemetry techniques. Further field surveys initiated in grasslands in Kokrajhar, Bongaigaon, Barpeta, Nalbari, Darrang and Sonitpur Districts of north-western and central Assam, contiguous with the Bhutan and Arunachal Pradesh borders.

1996: Construction of first pygmy hog breeding complex, Durrell House, comprising nine, interconnecting inside (stalls) and six outside (paddocks) enclosures, was completed in three months; this work also including several truckloads of tall grasses collected in Manas and Barnadi which were transplanted in the hog enclosures to simulate natural habitat. In mid-March 11 (6.5) hogs captured in Manas, of which six (2.4) were retained for captive breeding and transported to Basistha, and other five hogs released - four (3.1) after attachment of radio-harnesses. As expected, all three adult sows (the fourth sow being a subadult) were pregnant and all three give birth successfully approximately six weeks after capture. These births comprised a total of 13 (7.6) young, all but 1 (1.0) of which were reared successfully. Radio-telemetry and other studies initiated in Manas continued for the following nine months.

1997-1998: Project house/office, basic laboratory other facilities completed in Basistha in 1997, where routine husbandry and veterinary procedures were also refined close working relations developed with the local Veterinary College. All six founders and three yearling sows breed in 1997, resulting in production of seven litters and increase in hog population to 35 (19.16). First efforts to reduce productivity in 1998 result in the birth of only five litters, including the first full F2 litters ever produced in captivity, but total population still increases to 51 (28.33) individuals by December 1998, by which time a new quarantine facility and second range of hog enclosures (Magor House) completed with funding assistance from WM Group of Companies through the Assam Valley Wildlife Society. Dr Parag Deka, a veterinary graduate of the local Veterinary College, joins PHCP.

Repeat surveys in NW Assam and new surveys in SE Assam, NE Assam and Arunachal Pradesh, fail to locate any surviving hog populations. Little suitable habitat remaining in most of these areas; thereby also reinforcing the crucial importance of Manas and its bordering reserves as the last known habitat for this species. Field studies and development of habitat management recommendations in this area continue, and assistance provided in establishment of inter-agency network of local NGOs to intended to provide livelihood assistance in local communities and enhance local public awareness of related conservation issues.

The PHCP becomes more widely recognised and increasing numbers of visitors are attracted to the Basistha Centre, including diverse local and international conservationists, wildlife biologists, local decision-makers and regular groups of students, teachers, civil and forest service trainees. Conservation seminars and demonstrations are organised for school

parties, biology and forestry students, and lectures given at various educational and training institutions in Assam and elsewhere in India.

1999-2000: All of above activities continue, but periodic outbreaks of various infections (including *E. coli* and *Salmonella*) and continued growth of captive population provide cause for increasing concern. A third range of enclosures (Mallinson House) was constructed at Basistha in 2000 to help alleviate these problems, along with enforced segregation of same sex age groups. Nonetheless, this stock increased to a total of 68 (35.33) by December 2000. Plans drawn up for the development of a second breeding centre and pre-release enclosures at Dekorai Tea Estate (near Nameri National Park, with funding assistance from WM Group / AVWS), but early implementation is prevented by on-going negotiations for renewal of the covering agreement.

A survey of grasslands in the Brahmaputra Valley was carried out in collaboration with University of East Anglia researcher, Nick Peet, who had recently concluded similar studies in Nepal, but efforts to initiate a comparative longer-term study in Assam floundered owing to lack of funding support. Other surveys carried out during this period included monitoring of changes in habitat quality, protection status and management in Manas, and preliminary assessments of the protective status and quality of remaining grasslands in various other wildlife sanctuaries reserve forests in the region with a view to their possible suitability for future reintroduction projects.

Project Officer, Dr Parag Deka, underwent training at ITC in 1999, and the senior animal keeper at Basistha also attended a Central Zoo Authority (CZA) Zookeepers Training Programme in Assam State Zoo in 2000. The Project Manager presented a paper on the PHCP at the International Conference on Breeding Endangered Species in Captivity at Cincinnati Zoo in 1999. Important venues for invited lectures by project staff in 1999 and 2000 included classes for wildlife diploma and wildlife graduate students, and Wild Animal Management Courses for Zoo Directors and Senior Staff – both at the Wildlife Institute of India (WII) in Dehra Dun, and by the CZA in various zoos around the country.

2001-mid 2002: A new Memorandum of Understanding (MoU) for Phase II of PHCP was finally signed by the four original parties in March 2001. This event was also signified by the inaugural meeting of the new 'Governing Body', which was formed to oversee the future development of this Programme. This new body was constituted at the behest of the Assam Government, and is chaired by the Forest Secretary. Board membership places are also provided for representatives of each of the signatory parties, as well as other, senior Forest Department Officers and selected local academe and NGO representatives. A new Project Leader (S. K. Sen) was appointed, following the retirement of P. Lahan, who was Principal Chief Conservator of Forests (PCCF) of Assam, as well a former Trust Trainee and a long-term, active proponent of the PHCP. Another experienced forest officer and former Manas Range Officer, S. K. Sarma, joined the Programme as the Deputy Project Manager.

Unfortunately, however, the protracted delay in the signing of this agreement also coincided with changes in the senior executive of the WM Group, and a subsequent split in the holdings of this Group, and therefore their withdrawal of their earlier offer of extensive sponsorship support for the establishment of the second centre at Dekorai T.E. Related funding considerations, coupled with relative unsuitability of all but one of the many possible alternative sites investigated thus far, have therefore precluded this crucially important development; thus also exacerbating the over-crowding and inherent disease risk problems at Basistha.

By December 2001, there were a total of 75 (38.37) hogs at Basistha, which constitutes a 13 fold increase in this stock in six years – despite increasingly rigorous curbs

being imposed on the reproduction of these animals – a trend necessarily continued in 2002, where only one of the original (wild-born) sow farrowed. As a result, the Basistha population has been temporarily stabilised – indeed, following various recent losses, it had actually dropped slightly to 72 (35.37) at end of June 2002. Needless to say, however, there is irony, but little satisfaction, in managing the only captive stock of one of the world's most threatened species to minimise recruitment and prevent reproduction amongst the overwhelming majority of sexually mature individuals.

In the interim, lack of funds has also hampered long-overdue improvements to selected enclosures at the Assam State Zoo, intended to enable both the display of surplus (genetically over-represented) captive-bred hogs on loan from Basistha and facilitate possible further loans other collections nationally and (hopefully) internationally. Conversely, five years after the first proposal, the Centre for Cellular and Molecular Biology (CCMB), in Hyderabad, has finally agreed to carry out the DNA studies, with funding assistance from the Union Ministry of Environment and Forests. Blood samples taken from surviving founders or preserved tissue from dead ones were sent to CCMB earlier this year, with a view to determining the relatedness among the original six founders and their progenies.

Other recent activities include the appointment of a new Field Biologist, Bibhuti Lahkar, to assist in the collection of more field data, and who is currently studying floral and faunal changes in tall grasslands in Manas under differing management regimes, and flooding or burning conditions. These data are intended to assist development of recommendations to improve management of these and other areas, including possible future release sites. Selected animal keeping staff are also now being sent to the field for training and improve their understanding of the underlying conservation issues and principals behind the breeding efforts. Various local conservation awareness activities have also been stepped up in the environs of Manas, through strengthening linkages with local youth and other organisations and targeting public schools and other education institutions. It is hoped that these activities, which are being undertaken in collaboration with various other local environmental NGOs, will also lead to the conduct of 'trainers' training workshops' in Guwahati. A stakeholders' meeting was held in Manas to introduce the Initiative to the local people and assess their expectations, whilst efforts are being made to source the necessary funding for this project.

Appendix 4. Funding proposal

A FUNDING REQUEST

from

Durrell Wildlife Conservation Trust

to the

Chicago Board of Trade Endangered Species Fund

for $5,000

for a Conservation Workshop to Plan for Trial Release of Pygmy Hogs in Assam, India

A request submitted by: **February 2003**

Ms Karen Cowan	Donor Relationship Manager
Direct telephone	(01534) 860065
Direct e-mail	karen.cowan@durrell.org

Who We Are And What We Do

Durrell Wildlife Conservation Trust is an international conservation organisation working to save some of the world's most endangered animals. The Trust was founded by author and naturalist Gerald Durrell 44 years ago, at a time when few people recognised the alarming rate at which animals were vanishing in their native habitats. Today, Durrell Wildlife provides intensive hands-on management of endangered species at its Jersey Zoo headquarters and through conservation programmes to save 33 species in 13 countries around the world.

Gerald Durrell's passion for his vision produced results. In Mauritius the world's rarest falcon numbered only four birds when the Peregrine Fund and Durrell Wildlife began an intensive breeding and management programme. Today 800 Mauritius kestrels are flying free and the species is considered SAVED. In Madagascar the world's rarest tortoise now numbers 400 animals and a trial release programme has begun for the ploughshare tortoise. In Brazil the black lion tamarin, one of the world's rarest primates, numbered very few animals when a management programme, including zoo-based animals, was started to ensure genetic diversity. Today the wild population is 500 and Jersey-bred black lion tamarins have returned to the rainforest to boost numbers and contribute new stock to the species' gene pool.

Saving the World's Rarest Pig – The Pygmy Hog Project in Assam

Classified as critically endangered, the pygmy hog almost certainly survives in only one location in Assam. The species was considered to be extinct until the reappearance of a few animals in 1971. The pygmy hog is under considerable threat from indiscriminate burning of grasslands by village communities to force the re-growth of green shoots for cattle grazing. Tigers, rhinoceros, hispid hares and Bengal floricans share this threatened environment. Conservation measures are complicated by a serious security situation, which has resulted in parts of the habitat being overrun by insurgents. Durrell Wildlife signed an agreement with the Governments of India and Assam in 1995 to begin a captive breeding programme, field research and a land use management programme.

A breeding centre and research facility was built at Basistha, Assam under the direction of Dr Goutam Narayan, a graduate of Durrell Wildlife's International Training Centre in Jersey. Six wild hogs were captured in the Manas Reserve as founders and there are now 70 hogs in the centre. Villagers are being taught alternative grassland management strategies that reduce the need for burning and allow wildlife a means of escape to unburt areas while protecting the local economy.

The Next Step – Trial Release

Durrell Wildlife is now investigating the establishment of a second captive breeding site to serve as a half-way house for return of pygmy hogs to the wild. The hogs will be housed in very large semi-natural enclosures to encourage self feeding as a first step to trial release of some captive-bred hogs. Project staff are working closely with forestry officials and local people to try and identify habitat suitable for eventual release of captive-born animals and re-establishment of additional pygmy hog populations.

Critical Need For A Conservation Workshop

In order to prepare, agree and initiate plans for a trial release of captive-bred pygmy hogs, there is a critical need to hold a workshop in India. The week-long workshop will bring together local, national and international representatives. Each stakeholder (government officials, field biologists, researchers, animal managers, pig experts, conservation experts including the former chair of the IUCN Re-introduction Specialist Group and local villagers/community representatives) will provide a unique perspective of the pygmy hog recovery programme. It is vitally important that all these perspectives are brought together in one room to plan for a sustainable future for the hog.

Issues to be discussed would include technical, logistical, financial and political aspects of a pygmy hog release. Specific topics for debate would address the selection of release and alternative release sites, the nature and scope of pre-release facilities, capacity building and awareness raising among local protection staff and villagers, habitat restoration initiatives for the release site and local socio-economic issues in communities neighbouring the intended release area. Stakeholder “buy-in” and support will be crucial to the success of a trial release for the pygmy hog.

In partnership with the Pigs and Peccaries Specialist Group of the World Conservation Union, the Forest Department of Assam and the Ministry of Environment and Forests, India, a trial release of the pygmy hog is the culmination of 30 years of dedicated work to save the pygmy hog forever. A workshop will provide the forum to allow discussion of the critical issues, agreement as to the way forward and development of a detailed plan for the IUCN Re-introduction Specialist Group.

Estimated Budget

	Sterling	*US Dollar*
Local & National Participant Travel & Accommodation	£2,100	$3,400
International Participant Travel & Accommodation	£5,000	$8,096
Workshop Costs	£400	$647
Pre-workshop Data Gathering & Regional Consultation	£2,500	$4,048
Total	**£10,000**	**$16,191**

Durrell Wildlife kindly request the Chicago Board of Trade Endangered Species Fund to grant $5,000 to support a Conservation Workshop for the critically endangered pygmy hog of Assam. We intend to approach an individual donor for the balance of the funds required.