Conservation Strategy and Action Plan for Pygmy Hog in Assam 2008-2012

Pygmy Hog Conservation Programme

a collaborative project of

Durrell Wildlife Conservation Trust

IUCN/SSC Pigs Peccaries & Hippos Specialist Group

Forest Department, Govt. of Assam

Ministry of Environment & Forests, Govt. of India

with local project partner

EcoSystems-India

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Summary

Current status and threats

IUCN Red List Category – Critical (CR A1c, B1+2cd, E) 1996
Indian Wildlife (Protection) Act, 1972 – Schedule 1 (most threatened)
CITES – Appendix 1
Wild pygmy hog (*Porcula salvania* syn. *Sus salvanius*) is currently known to exist only in a single site in the world – the Manas National Park in Assam, India. Here too both the species and its habitat, the early successional, tall alluvial, foothill plains grassland, are seriously threatened. In the past, habitat loss and degradation were the main causes for decline of the species. Currently, management and protection of existing grassland ecosystems are the main concerns.

Goal

Ensure survival of pygmy hog into perpetuity.

Strategy

- Reduce decline (declining population paradigm)
- Promote recovery (small population paradigm)
  - increase absolute numbers
  - increase populations
  - increase available habitat

Objectives

Short-term objectives

- To increase the number of sites in Assam with viable wild and captive pygmy hog populations to three each.
- To help in improved protection and management of the habitat at the existing and reintroduction sites for survival of this and other sensitive and native species of the grassland habitat.

Long-term objectives

- To assist recovery of the species by reintroducing captive-bred hogs into all suitable habitats remaining or restored in their former known range.
- To facilitate enhanced understanding of the species and its keystone role for better management and conservation of natural biodiversity in early successional alluvial grasslands of Himalayan foothill plains in the Indian sub-continent.

Conservation action needed

- Field surveys to determine status of pygmy hog grasslands
- Conservation breeding and reintroduction of pygmy hogs in restored and protected habitat
- Ecological studies in the grasslands of existing pygmy hog site and the release sites
- Capacity building of protection and management staff of relevant PAs
- Community conservation interventions in fringe areas of these PAs
- Awareness generation and publicity about the need to conserve pygmy hog and its habitat

Current and proposed activities and their possible impact

Pygmy Hog Conservation Programme, a broad-based, multidisciplinary collaborative project for conservation of pygmy hog in particular and biodiversity of alluvial grasslands in general, was launched in 1995 in Assam. It is currently involved in conservation breeding, capacity building and awareness generation programmes, and has also conducted status surveys and ecological studies. It is working closely with relevant PA authorities for restoration of release sites and management of existing site. It plans to undertake reintroduction of captive bred hogs in restored grasslands and strengthen wildlife monitoring and habitat management by protection staff. It is also intensifying community conservation interventions in the fringe areas of the study areas. The main impact of these initiatives should result in fulfillment of project objectives and the ultimate goal of preventing extinction of pygmy hogs from wild and ensuring conservation of other endangered species of its habitat.

Introduction

The pygmy hog (*Porcula salvania* syn. *Sus salvanius*) is the smallest and the rarest wild suid in the world. IUCN has accorded this species the highest priority rating of all Suiformes, and it is considered to be amongst the most endangered of all mammals (IUCN 2007). An inhabitant of undisturbed expanses of early successional alluvial grasslands plains south of Himalayas, it has disappeared from its entire range except one location.

The pygmy hog is a highly sensitive species and an important indicator of its habitat. It has disappeared from many tall grassland areas that continue to support many other species of the ecosystem. It also shows the impact of wildlife management practices in its habitat. Its survival of is closely linked to the existence of the tall and wet grassland habitat dominated by *Saccharum – Narenga – Imperata* association of grasses, which being a highly threatened ecosystem, is crucial for survival of a number of other endangered species such as the great Indian one-horned rhinoceros (*Rhinoceros unicornis*), tiger (*Panthera tigris*), swamp deer (*Cervus duvauceli*), wild buffalo (*Bubalus bubalis*), hispid hare (*Caprolagus hispidus*) and Bengal florican (*Eupodotis bengalensis*). It is therefore important to understand why it is disappearing faster than other less sensitive species and take remedial actions if we wish to preserve the original biodiversity of its habitat.

1. Current status

Originally found in a narrow grassland belt south of Himalayan foothills in the Indian subcontinent ranging from Uttaranchal to Assam, through Nepal *terai* and Bengal *duars*, it is now reportedly extinct in Nepal and Indian states of Uttaranchal, Uttar Pradesh, Bihar and West Bengal (Griffith 1978, Oliver 1984). Never reported to be plentiful it was even suspected to be totally extinct by 1960s (Gee 1964), but their rather reappearance near Barnadi in Assam in 1971, however, generated a lot of interest in conservation and their continued existence in Manas and some other isolated areas of northern and north-western Assam was also brought to light (Oliver 1980). The animal's status in the wild, however, continued to deteriorate rapidly and it had disappeared from all but two sites in Assam by late 1980s (Oliver and Deb Roy 1993). After 1995 there are no reports of the species from Barnadi Wildlife Sanctuary, and currently, the viable wild population of the species survives only in Manas National Park, Assam, and nowhere else in the world.

2. Causes of decline and present threats

First described in 1847 from the present northern West Bengal (south of Sikkim), the species was never reported to be very common. It lost most its habitat to spreading cultivation by rapidly expanding human population. After the 1970s, the primary cause of its disappearance, even from the seemingly protected areas, was habitat destruction resulting from indiscriminate grass burning, thatch gathering, livestock grazing, flooding by irrigation projects, tree plantation under forestry operations, and encroachment by human settlements. Although opportunistic hunting by humans for wild meat may not be a major cause for its decline, this may have contributed in extirpation of some depleted populations, and continues to be a threat in even its last abode.

3. Current activities and plans

3.1. Conservation breeding for reintroduction

A recovery programme for the species, the Pygmy Hog Conservation Programme (PHCP), was initiated in 1995 as a collaborative project of the Durrell Wildlife Conservation Trust (DWCT), IUCN/SSC Pigs Peccaries & Hippos Specialist Group (PPHSG), Forest Department, Govt. of Assam and the Ministry of Environment & Forest, Govt. of India. Although the main aim of the programme is conservation breeding for reintroduction in the wild, the captive population is also an insurance against the possible early extinction of the species in the wild.

The major activities and progress made under PHCP include development of a breeding centre, capture of wild hogs from Manas, development of husbandry procedures, and birth/rearing of hogs in captivity. The Programme's other objectives include development of an optimum management protocol for reintroduction of the captive-bred animals and to undertake trial release of pygmy hogs back into restored, well managed and properly protected habitats from where the species had disappeared in the recent past. An extensive pre-release facility has also been established now and the large pre-release enclosures with simulated natural grassland habitat will be used to prepare the captive hogs for release in the wild.

In 1996, six wild (2Γ 4E) hogs were caught from the core area of Manas Tiger Reserve and transferred to a custom-built research and breeding centre at Basistha near Guwahati, about 100 km southeast of capture site. The breeding programme exceeded early expectations to become quite successful and the captive population increased 12 times during the first five years. Due to space constraints and low number of founders (permission for more founders was not granted in 1996) the size of the captive population has been restricted since the year 2000. Currently the captive population is 80 (36Γ 44E) and this constitutes the only captive population of the species in the world.

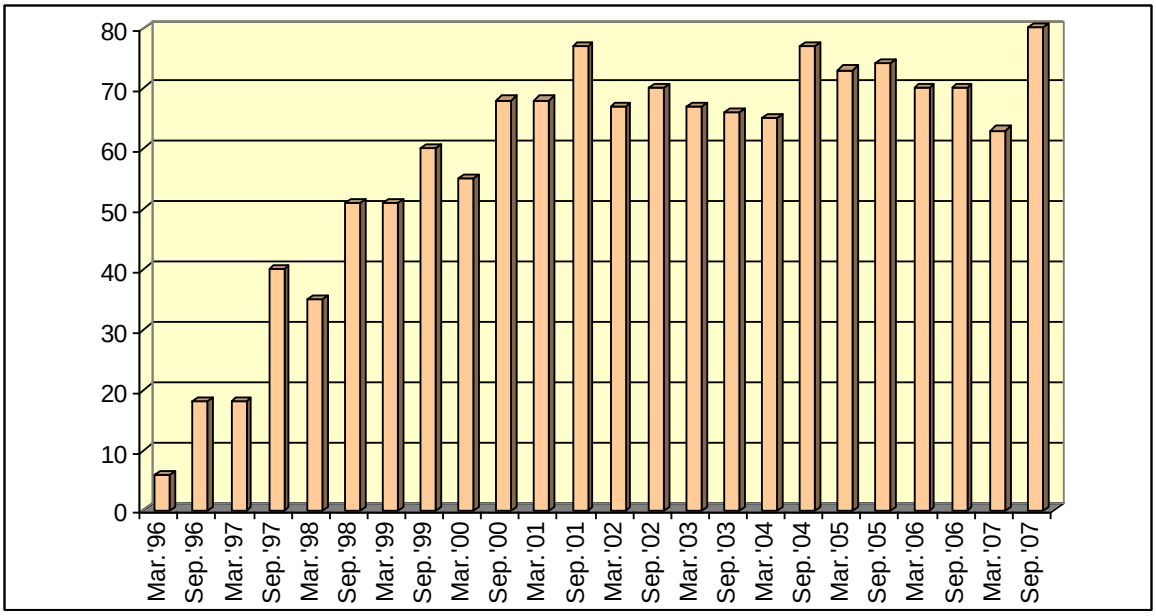
Nine captive born hogs have been taken to the Programme's pre-release facility at Potasali near Nameri national Park. Although most of them have been kept in the holding enclosures there, one of the four pre-release enclosures is being tried using two hogs. Later this year, two small groups of hogs targeted for release in the wild will be kept in separate pre-release enclosure under minimal human contact and their habitat use and behaviour will be monitored. Proactive measures to prepare these hogs for life in the wild will be undertaken and they will be encouraged to forage for natural food. Encouraging preliminary results with other hogs at Potasali have indicated that these groups should become ready for release in 5-6 months when they will be taken to release site.

The Programme is working closely with the authorities of Sonai Rupai Wildlife Sanctuary where the first releases will place. A monitoring cum protection camp is being established at the release site. The frontline staff of the camp will under go training in wildlife monitoring and habitat management. A trainers and monitors training programme, similar to one held in Manas in March will be organised at Potasali in early November. Accredited trainers from Sonai Rupai, Nameri and Barnadi will be used to train other frontline staff in these techniques.

The fringe area community near Sonai Rupai is also being sensitised before the release process and community conservation initiatives will soon be initiated in lines with similar

efforts around Manas. Livestock disease risk and other potential health problems for the released hogs will be assessed in and around Sonai Rupai. Although the preliminary studies indicate that the habitat in Sonai Rupai grasslands, where pygmy hogs were found in the past, is suitable for the hogs, a more detailed habitat analysis using M.Sc. or Ph.D. students will be launched this year. A vegetation map of the area will also be prepared using satellite imagery.

In the light of recurring failures of earlier attempts to breed pygmy hogs in captivity in Assam and elsewhere, the success of Programme is highly significant. It has demonstrated the ability to produce pygmy hogs in captivity at a phenomenal rate (the captive population of this sensitive species went up by 1200%, from 6 to 72, in five years). The captive population is capable of providing large numbers of animals in a relatively short period for time reintroduction projects, provided adequate space and resources are made available.



Population of captive hogs with Pygmy Hog Conservation Programme (1996 – 2007)

PHCP Research & Breeding Centre, Basistha

Captive hogs in simulated natural habitat

3.1.1. Pre-release

The captive hogs at the Basistha conservation breeding centre cannot be directly taken to the release sites as they need to learn and 'unlearn' a few things in order to survive in the wild without support. Over the last seven years, human settlements (mostly illegal encroachments) have proliferated in the Basistha area of Garbhanga Reserve Forest. Several official establishments have also been developed on the lands adjoining the conservation breeding centre despite objections of the Programme. These developments were not foreseen and have substantially increased the risks to the animals. To enable production of more hogs and maintenance of some these animals in more naturalistic habitats and socio-reproductive groupings prior to release, large enclosures with natural vegetation are required. Owing to space constraints and other factors at Basistha, many of these activities cannot be carried out there.

Large pre-release enclosures at Potasali with simulated natural habitat will be used to prepare, habituate and 'train' then for survival and self sufficiency in the wild. Since the Basistha population constitute the entire global captive population of the species, the holding enclosures (existing) and additional breeding enclosures (planned) at Potasali would provide insurance against any catastrophe at Basistha.

Location and description of the Potasali Pre-release Centre

In 2004, a 5 ha plot of land at Potasali was allotted to PHCP by the Assam Forest Department for development of the pre-release centre. Later, a 25-30 m wide belt of land around the plot, measuring around 2 ha, was acquired for creating buffer zone. The site is located next to the wildlife Range Office for Nameri National Park in Sonitpur district of Assam, about 35 km north of Tezpur town. The site is technically within Balipara Reserve Forest and lies within the former range of the pygmy hogs. However, the surrounding areas consist of the Forest Range office, staff quarters, an eco-camp for tourists, a small tree plantation, a couple of forest villages, and marginal cultivation practiced by the local villagers. Electricity connection exists but the area goes without power for weeks or even months due to frequent breakdowns, so solar power systems have established for the electric fence, water supply and lighting needs.

The design of the pre-release centre has been prepared carefully in order to address the behavioural and welfare needs of the captive individuals intended for release in the wild.

The following infrastructure have been established

a. Two large pre-release enclosures (about 3200 m^2 each) with carefully simulated habitat where socio-reproductive groups are maintained under minimum management intervention or other human contact.
b. Two social group isolation enclosures (about 2400 m^2 each) with similar habitat.
c. Low (1 m high) bamboo-cum-electric fence around each of the above four enclosures; a nestling supplementary feeding area with remotely operated gates in each enclosure.
d. A display cum holding unit with four small paddocks (75 – 150 m^2 each) and an animal house with four stalls. Two of these paddocks are visible from a small (5 m^2) observation hut for visitors (the pre-release and isolation enclosures will be totally out of bounds).

e. An animal food preparation area with a pest-free food and equipment store.
f. A central observation platform made of bamboo.
g. A perimeter security fence (about 750 m of 2.25 m high chain-link fence on iron angles with two hot lines on top) to protect the above units from human and livestock intrusion.
h. A power fence outside (about 1000 m of 5-strand electric fence on wood and concrete posts).
i. A 25-30 m wide buffer zone.

The following additions / modifications need to be carried out:

j. A stronger central watch-tower with a hog recapture area on its ground floor that will be connected to each of the four supplementary feeding area.
k. Planting of high grass in the buffer zone between the perimeter and power fence.
l. Residential huts for four field assistants (four basic rooms with a kitchen and common facilities).
m. A project office hut with an extra room (for overnight stay) and laboratory.

Outer power fence at Potasali

Perimeter security fence at Potasali

A pre-release enclosure with bamboo-power fence

A holding enclosure at Potasali

Availability of suitable release stock

The hogs to be released are the descendants of the six founders caught from the wild (Manas NP) and will be only be reintroduced in protected areas that currently have no known wild populations. As these release sites have the suitable grasslands to support the hogs, the preferred habitat of the hogs will not be compromised. The hogs will be withdrawn systematically from Basistha and taken to Potasali pre-release centre for preparing them for survival in the wild, followed by final release into wild.

Earlier research conducted by Oliver (1980) and Oliver and Deb Roy (1993) provides baseline information on the characteristic needs (preferred habitat, diet, predators, status, distribution area, etc.) of the pygmy hogs in Manas NP. However, little was known about health status of wild populations until the records maintained by PHCP on the health status of the captive hogs. PHCP has forged close association with the local veterinary college professionals for assistance in the event of medical emergency, and disease diagnosis and research. Also a network with local and international veterinary experts for information exchange is being maintained. A system of regular recording of clinical behaviour of some common diseases (salmonella, urinary ailments, piglet diarrhoea), methods of early diagnosis and treatment, and disease prevention through proactive health protocol (hygienic measures, limiting biological pests, reducing weather stress and disease monitoring by behavioural observation and laboratory screening) and reactive health protocol (isolation of sick hogs, use of separate keepers and utensils, use of preventive medicine in suspected hogs) have also been developed.

In anticipation of the reintroduction plans, the following protocol has been established:

(i) animal husbandry (working schedule, animal catching, animal movements between enclosures);
(ii) breeding management (selection, pairing, farrowing, animal and hoglets);
(iii) behavioural enrichment (attracting insect growth in the paddocks to fulfil their foraging behaviour, planting of different varieties of grass and shrubs in paddocks collected from natural habitat for building nest, creation of water pools in paddocks for wallowing, promoting social interaction between groups and sex through paddock gates);
(iv) feeding and nutrition (preparation of balanced diet using a range of 33 feed items including roots, tubers, fruits, cereals);
(v) animal database (maintaining daily animal record, stock register, breeding information).

This protocol will help in selection of the animals for release.

Even though the breeding programme has encountered certain health problems since its initiation (Chakraborty *et al.* 1999, Rahman et al. 2001), the current captive population does not show any external signs of poor health. As the breeding programme is a pioneering effort, there are no previous health studies on wild pygmy hogs to ascertain the health effect of captive population when reintroduced in the wild. However, health concerns can be dealt with at present as the release sites have no wild populations currently.

To determine the relatedness among the original six founders and their offspring, DNA studies have been initiated at the Centre for Cellular and Molecular Biology, Hyderabad, using blood samples taken from surviving founders or preserved tissue from dead ones. Although the samples have resulted in discovery of the fact that pygmy hog is not as closely

related to *Sus* and belongs to a monotypic genus *Porcula* (Funk *et al.* 2007), the relatedness studies, unfortunately, did not make much headway and needs to be revived.

Although rapid increase in the numbers of captive pygmy hogs at Basistha had created a space problem, it was necessary to increase the captive population for better genetic heterozygosity within this population. It is also important to bring in some additional founders and disperse some captive-bred animals that are not very useful in the breeding project. Incipient over-crowding problems have necessitated both indirect (increasing regulation and control of pairings, isolation of males and females) and direct (experimental contraception of females) methods of population control. A breeding management protocol has been developed to produce genetically valuable breeding pairs for trial release.

Further, because pygmy hogs do not exist at the proposed release sites (Nameri NP and Sonai Rupai WLS), and the founders were captured form a population (in Manas) that must have had links with erstwhile populations at the release sites, it is being assumed that there will be no genetic and taxonomic variations.

3.1.2. Release

Selection of Release Sites

Almost all sites in Assam from where pygmy hogs were reported in the past and a few sites that may have become suitable for the species over time (e.g. Orang) were surveyed in order to identify the release sites.

Two sites in Assam (Sonai Rupai Wildlife Sanctuary and Nameri National Park) were shortlisted and are described below with reasons for their selection. These two Protected Areas (PAs) do not have pygmy hogs now but possess suitable habitat. Both these area had recorded the occurrence of pygmy hog in the past. Till the late 1970s the species was definitely present in Nauduar Reserve Forest (Oliver 1980) a part of which was re-designated as Nameri. At Sonai Rupai the species was last reported around 1950s but it was present in some pockets of adjacent Balipara Reserve Forest till 1977 (Oliver 1980).

Sonai Rupai Wildlife Sanctuary

Sonai Rupai is located in the north-western part of the Sonitpur district of Assam (approx. 26°55'N and 92°30'E) bordering the mountainous state of Arunachal Pradesh. The 220 km^2 sanctuary consists of alluvial terraces in the Himalayan foothills and its vegetation comprises tropical semi-evergreen moist deciduous forests interspersed with large open grasslands in the plains. The hilly parts have tropical forests of *bhabar* type.

Although the protection status of Sonai Rupai was upgraded from a reserve forest to a wildlife sanctuary over two decades ago, the final notification to this effect came only in 1998. Even now the sanctuary is managed by a non-wildlife forest division (Sonitpur West Division) and the protection machinery remains inadequate. An Army firing range is located in the core area of the sanctuary that is near one of the largest cantonment in the region

Despite inadequate protection, the habitats in some parts of the sanctuary remain intact. Besides some good stands of tropical forests along the foothills, a couple of alluvial grasslands patches in the south-eastern part of the sanctuary appear similar to those in Manas, dominated by *Narenga-Imperata-Saccharum* association. These are the Kalamati grasslands (*c.* 1 – 1.5 km^2) and the better, Gelgeli grasslands (*c.* 2 – 3 km^2) and several

smaller patches along the rivers in the sanctuary. These grasslands are however burnt extensively every year, mainly by now illegal thatch collectors who want to promote the growth of *Imperata* and other thatch grass varieties.

Although the pygmy hog has not been reported from the Sanctuary for over 50 years the habitat in some patches (e.g. Gelgeli) has not deteriorated much since late 1970s, when Oliver (1980) had observed that it would be an ideal area for reintroduction of pygmy hog. These do appear to be the best options for trial-release of the captive bred hogs.

The Gelgeli protection camp was destroyed by some intruders when it was deserted and left unguarded in the 1990s due to logistic problems and very high incidence of malaria (*P. vivax* as well as drug resistant *P. falciparum*). The Forest Department is now re-constructing the camp to revive it and it will be used as protection and monitoring camp for the released pygmy hogs and other wildlife. The sanctuary authority (DFO, Western Assam Wildlife Division) has requested PHCP to contribute towards refurbishing the camp and to install a solar power system for lighting and security power fence. It has also request the Programme to explore if funds can be raised for construction of another camp closer to Kalamati grassland as the Forest Department itself does not adequate funds for it.

Nameri National Park

Nameri was upgraded from a Wildlife Sanctuary to a National Park in the last decade and is one of the better protected areas of Assam. Located less than 20 km east of Sonai Rupai in Sonitpur district (approx. 27°N and 92°50'E), Nameri and the neighbouring Pakhui Wildlife Sanctuary of Arunachal Pradesh have been brought under the Project Tiger recently. The soil and vegetation is similar to that of Sonia Rupai, except that the grassland patches are mostly restricted to narrow river valleys and banks. Five of these patches (Potasali, Kari, Baithakata, Upper Dikarai and Nameri) varying from 0.5 to 2 km^2 in size are located on north-central part of the Park and are better protected. The grass association in these patches are not very similar to those in Manas and Sonai Rupai and perhaps due to less frequent burning; they are more diverse in their species composition. As most of these grassland patches are well drained, it is possible that pygmy hog did exist here in the past as reported by Oliver (1980).

Two larger patches (3 and 5 km^2) in the southern Nameri are located on the northern bank of Bar Dikarai River and near its confluence with Jia Bhareli, an area that was added later to the Park. Unfortunately, these two more suitable grasslands are degraded and disturbed by presence of hundreds of buffaloes and cows in several *khutis* (cattle camps) that are based in the area. Efforts are being initiated by the authorities to relocate these *khutis* outside the Park, and once this is achieved, the patches can be developed into grassland similar to those in Manas or Sonai Rupai, and used for trial release of hogs after proper restoration and protection.

Release of captive stock

The effort to maintain the environment of the captive hogs similar to their present wild habitat will facilitate the release of animals. While only necessary human contact with captive hogs is maintained at the Centre, the hogs nevertheless are used to human presence. The pre-release facility would ensure complete isolation of the hogs before reintroduction.

At the trial release sites, there are no unusual threats from any predator that is or was not prevalent in the present or past areas of hogs' distribution.

Efforts would be taken to release as many young animals as possible along with a few older individuals. Typically, a few sows with their litter of young hogs (6 to 9 month olds) and one or two unrelated adult males would be released at the trial reintroduction sites.

Haematology, pathology and microbial investigations will be undertaken prior to final release to prevent transmission of known pathogens to humans or livestock.

Socio-economic and legal requirements for release

The reintroduction plans have the support of all collaborating agencies of PHCP, but the post-release protection of the hogs mostly vests with Assam Forest Department, which controls all the protected areas in the state. The release sites being part of the PAs will ensure a safe refuge for the reintroduced animals to a large extent. The government being a party to PHCP's reintroduction plans, no legal hindrances are expected. Preliminary discussions on reintroduction in release sites (PAs) have been conducted with concerned forest officials. However, the existing threat of habitat destruction prevails despite their protected status. Unscientific and unplanned burning of grasslands by the forest staff as well as the villagers in the vicinity of the PAs, livestock grazing in the sanctuary, collection of thatch and grass, encroachment of the grasslands for habitation and agriculture exist in these and other PAs. Although the short-listed release sites are largely free from these problems these cannot be ruled out unless the protection machinery is strengthened significantly. To counter such threats, PHCP has plans to sensitise forest department staff as well as the community through capacity building in scientific grasslands management techniques and environment education, develop community based mechanisms for harvest of thatch and grass, and involve local community members in monitoring of the reintroduced hogs, prior to final release of the animals. This process will entail the participation of local environmental NGOs, academic institutions and forest staff. The Assam Forest Department will be kept informed of the progress made in the various stages of the reintroduction process.

Planning, preparation and release stages

The concept and plan for the proposed trial release has been discussed with local authorities and international wildlife managers and conservationists and has been generally accepted by them. Recommendations concerning selection of the release sites have been conveyed to the Assam Forest Department. In addition to initiating preparations for release, other options for the Species Recovery Programme are being explored.

The release programme will be conducted in three-phases. The first phase was to make suitable captive bred stock available for release and it has been successfully demonstrated that required number of genetically and physically healthy individuals can be produced provided adequate number of founders are included in the breeding project. Unfortunately, the breeding project was started with six individuals as government permission to catch more founders was not granted in 1996. In the Governing Body meeting, capture of additional founders has been approved with the condition that an additional captive care centre be established for the species, which in any case is essential given that the all the

captive pygmy hogs are at one place. To this end it has been suggested that the proposed pre-release centre will also serve as the second breeding centre.

The establishment of the pre-release centre, where the hogs targeted for release would be kept for a few months under minimal human contact and they would be encouraged to forage and behave as naturally as possible, marked the second phase of the programme. The hogs will be subjected to thorough physical examinations and their faecal and blood samples will be taken for detailed pathological investigations prior to shifting them to the pre-release centre. The acclimatization will require the hogs to be housed at the pre-release centre for about six months, before being transported to the release site in custom-built wooden crates by road; they hogs will be sedated to minimize stress during the journey

In the third phase, the selected hogs would be translocated to the identified trial release sites, perhaps sometime in early 2005. These hogs would undergo rigorous health check-up that would be as non-restrictive and non-invasive as possible. As stated above the release stock for each trial release site would include 4-5 females (aged between 3 and 5 years) with their litter of 3-5 young ones, who would preferably be born and raised at the pre-release centre in 2004. Two or three males aged between 2 and 4 years will also be released at each site. Care would be taken to release as many unrelated adults as possible.

These phases would be repeated for at least 3 years at each trial-release site, thereby releasing 70-80 individuals at each site. The released hogs would be monitored (see below) and methodologies reviewed every year to improve the survival of the released hogs.

All animals targeted for pre-release site would be marked for identifications and microchip transponders would be inserted in individuals before trial release in the wild. A couple of adult females and males at each trial release site would be fitted with radio-harnesses specially designed for the species that would help us track them using radio-telemetry equipment. Lessons learnt from similar exercise in the past (Oliver 1980, Narayan *et al.* 1999) will be used for improvement in equipment and methodologies. Regular monitoring over next one year or so would indicate the survival and movement of the tracked individuals.

Success Indicators

In short-term the success indicators would be the continued activity of the radio-tracked individuals and other signs (e.g. active nests, foraging marks) of survival of the released animals. In the long term it would be successful breeding of some of the released individuals, to be determined through sighting of farrowing nests and young ones after two years or so.

Habitat restoration and protection

Habitat restoration initiative in the grasslands of the identified trial release sites would include

- cutting of fire lines and clearing of natural drains for prevention of accidental burning and flooding;
- protection against livestock grazing, thatch collection and other human use.

The PA managers would be encouraged to adopt scientific habitat management regimes as good habitat management would help in conservation of this as well as other threatened species of the grassland.

3.1.3. Post-release activities

Monitoring will be based on radio-telemetry and direct observations. Continued collaboration with local communities and Forest Department will be maintained throughout the project to ensure sustained protection of the site from habitat destruction and collection. Resource use in and around the sanctuary will be monitored. A review of initial success and proposal for future action will be made a year after the first release.

3.2. Status surveys

Wide-ranging status surveys for pygmy hogs between 1995 and 2001 highlighted the extremely precarious situation of the species. The surveys covered grasslands in Kokrajhar, Bongaigaon, Barpeta, Nalbari, Darrang and Sonitpur districts of north-western and central Assam (including the present Bodoland Territorial Autonomous Districts of Chirang, Baksa and Udalguri), along Assam's border with Bhutan and Arunachal Pradesh. Besides Manas NP and RF, other notable sites under these surveys included Chirang, Subankhata, Khalingduar RF, Barnadi and Sonai Rupai WLS, Chariduar, Balipara and Nauduar RF, and Nameri NP. It was confirmed that the only viable population of pygmy hogs survives in Manas National Park. Other remnant population in the region had been decimated and no new population was found. Even the last populations in Manas were under threat from management problems, or rather lack of management, due to severe political unrest and resulting security situations. After 2001, rapid field surveys were carried at regular intervals in many of the above areas to assess the current protection status as well as the grassland habitat management practices prevalent in other protected areas of Brahmaputra valley. Besides above locations, surveys were carried out in the extensive grasslands of Orang and Kaziranga NP from where pygmy hogs were never recorded.. Attempts were also made to survey some bordering areas in Bhutan but the political strife, insurgency problems and military operations along the international border prevented repeated visits and proper assessment.

Efforts will be made to survey some areas under Chirang RF not covered earlier, as well as those near Barnadi WLS, particularly in and around Khaling RF of Bhutan.

3.3. Habitat management studies and recommendations

The main objectives of the habitat management studies in Manas and release sites are to formulate recommendations for improved management of the tall-grasslands. This is being achieved through enhanced scientific knowledge of the status of the habitat and the impact of various management interventions and other factors on the habitat and its indicator flora and fauna. The main focus is on unsustainable levels of annual dry season grass burning, extraction of thatch, and lack protection against of livestock grazing. Although some evidence of the deleterious effects of these activities have been documented in Bansbari range of Manas National Park, the need is to conduct out more rigorous experiments to scientifically record the impact in all the areas of Manas and in the selected release sites.

Grassland ecology studies in Manas

Data on current grassland management practices in Manas in different seasons and preliminary information on diversity of selected species in the grasslands under different management regime were collected. Information on grass associations and vegetation patterns were 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.

The results of these studies and the surveys carried out under the Programme has provided provide baseline data for developing more detailed, collaborative grassland ecology studies. Future studies in the grasslands too will try to re-assess the current status of pygmy hog (*Sus salvanius*), hispid hare (*Caprolagus hispidus*), wild buffalo (*Bubalus bubalis*), swamp deer (*Cervus duvauceli*), greater one-horned Indian rhinoceros *Rhinoceros unicornis*), Bengal florican (*Houbaropsis bengalensis*), swamp francolin (*Francolinus gularis*) and some disappearing turtles and terrapins of these grasslands. After identifying major threats to their survival, specific recommendation for improved management in each of the study sites will be formulated. These studies follow methodologies of similar studies undertaken by researchers from the University of East Anglia in Nepal (Peet *et al.* 1997) and Bombay Natural History Society in India (Rahmani *et al.* 1997, Narayan 1992). Both Gauhati University and the Bombay Natural History Society have expressed interest in participating in any future studies, for which the Assam Forest Department, which manages all these protected grasslands, has indicated its strong support. .

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 grassland habitats.

Conservation problems and needs

The main threats to survival of pygmy hogs are loss and degradation of habitats due to human activity. The Programme has highlighted the current conservation problems faced by the species and its habitat and is both leading and advocating a number of remedial actions. The few remaining tall grasslands in north-eastern India are under enormous anthropogenic pressure, made worse by traditional (and deeply entrenched) management practices; especially too extensive dry season burning, commercial re-afforestation, thatch grass harvesting and domestic livestock grazing. In many cases these practices are illegal, but enforcement of protection activities are severely hampered by lack of resources, political will, bureaucratic inertia and, most recently severe demoralisation of park and forest staff personnel resulting from local administrative and insurgency problems. Illegal trapping and killing of wildlife in Manas has already taken the toll of larger mammals, such as the rhinoceros, tiger, swamp deer and hog deer, and in absence of effective protection measures, it has begun to affect even smaller species such as pygmy hogs.

Whilst most of these problems could be resolved with some administrative and political will, the severe insurgency problems in many areas are a serious deterrent. Nonetheless, a coordinated and sustained effort by the authorities in collaboration with local conservation

groups can save this and a number of other highly threatened grassland species. There is little doubt that if urgent steps to protect and conserve these habitats are not taken it may lead to further decline and even extinction of some of the most endangered species. The Pygmy Hog Conservation Programme has highlighted conservation status of some critical grassland areas through reports and publications. The management and protection problems for some of these critically important areas such as Manas, Barnadi, and D'Ering have been conveyed to relevant authorities with suitable recommendations (Oliver et al. 1997, Narayan et al. 1998), but little effective action has been taken except, to some extent, in Sonai Rupai.

Past recommendation against grass burning

Since grass fires are extremely rare events in the wet alluvial grasslands, it has been found that intentional burning is a catastrophic event for a large number of small mammals, ground nesting birds, reptiles and invertebrates. Moreover, regular annual burning reduces the floral diversity as it favours plants that like fire, and consequently affects the resource availability in these habitats for its natural inhabitants.

The recommendations prescribed stopping of indiscriminate dry seasons burning as practised in almost all grasslands in Assam. If burning needs to carried out as a tool against invasion of trees and weed or to prevent succession of the habitat, it recommended early block burning in alternate years. Specifically, the recommendations were:

a. Mark out block in a grassland using fire lines and burn each block in winter (e.g. in December – January, when the grass leaves are still not fully dry) in alternate years;
b. Do not burn adjacent blocks in the same year and never burn more than a third of the entire grassland area in any given year.
c. Never burn grass in the dry season (February to May), and if a winter is missed due to any reason, burn the block after the wet season.

However, there is considerable resistant among some Forest Department officers and protection staff against the grass burning regime. They still believe that annual dry season burning of grass is essential to prevent conversion of these successional grasslands to next stages of the succession, and often take less sensitive species like rhinoceros as indicator to show the apparent success of this long prevalent practise. One of the frequent complaints against above recommendations is that the grass is still wet in winter and does not burn properly. It has been repeatedly pointed out the 'proper' or complete burn in not desirable and the slow, 'cold' and incomplete or patchy burn is much less harmful than rapidly spreading, 'hot' and full burn that chars even the soil, let alone any small animal in the grass. In the last ten years or so, PHCP and IUCN/SSC PPHSG have been able to convince some managers and a large section of conservation community in Assam about the harmful effects of indiscriminate burning. Continued advocacy and efforts to get these recommendations incorporated in the management and action plans of the PAs with grassland is necessary.

The effects of these activities on densities of pygmy hog and other associated species will be measured more accurately in future.

3.4. Training and outreach activities

Because some current management practices such as annual dry season grass burning are aimed to help only misguided requirements of some large mammals that attract tourists, this has undoubtedly, and catastrophically, impacted on the survival of many iconic species. In addition, anthropogenic pressures such as livestock grazing and thatch harvesting (for roofing thatch and domestic animal fodder) as well as hunting for bush-meat and other resource extraction (e.g. small timber and firewood), is further degrading the habitat and decimating wild animals.

This project aims to address these issues in four such Protected Areas (PAs) in Assam: Manas, Nameri, Sonai Rupai and Barnadi, that have either lost or are suffering from rapid degradation of the grassland habitat and loss of associated fauna. This will be achieved (a) by building technical capacity of the PA staff through training in conservation management and monitoring, and (b) by mobilising community conservation action in select fringe villages through interventions to reduce forest resource extraction and mitigation of human-wildlife conflict.

The project aims to build capacities and partnerships among local stakeholders for effective conservation in the project area through:

- Enhancement of skills of Forest Department frontline staff for better monitoring of some key indicator species and their habitat.
- Training in conservation management and law for Forest Department officers.
- Training trainers from select local civil society organisations (CSOs) such as NGOs, youth and nature clubs, schools to undertake conservation and awareness initiatives independently as well as in partnership.
- Development of a training and community conservation centre at Manas to provide sustained support for the above activities even after completion of the project

Training programmes for frontline staff and establishment of a training cum community conservation centre have already been started in Manas. If necessary, the project will provide incentives to Forest Department frontline staff and fringe area community to encourage improved protection and monitoring.

The Project is also taking community conservation initiatives in the fringe villages to:

- Reduce resource extraction and human / livestock disturbances inside the protected areas
- Promote sustainable use of natural resources in the villages for direct economic benefits to the community
- Mitigate human-wildlife conflict

4. Action plan

4.1. Goal

Ensure survival of pygmy hog into perpetuity by establishing reintroduced populations into suitable habitats remaining within its former known range, and facilitating implementation of improved habitat protection and management regimes in all areas supporting this species that will also help maintain optimal biodiversity.

4.2. Objectives

1. Assist recovery of the species by reintroducing captive-bred hogs into suitable habitats remaining or restored in their former known range
2. Develop and assist implementation of habitat management plans in existing wild and proposed release sites; monitor wild pygmy hog populations.
3. Build the capacities of relevant stakeholders, including Forest Department and select civil society and conservation organisations for enhanced protection, management and conservation of the grassland habitat in the sites where the pygmy hogs exist or will be released.
4. Initiate and sustain community conservation interventions in the fringe areas of the existing and release sites.
5. Raise awareness of the importance of conserving grassland fauna and habitats at the local, state and national levels.

… … … *Continued on the next page*

4.3. Proposed activities

<table>
<tr><th>2008</th><th>2009</th><th>2010</th><th>2011</th><th>2012</th></tr>
<tr><td colspan="5">Objective 1
Assist recovery of the species by reintroducing captive-bred hogs into suitable habitats remaining or restored in their former known range</td></tr>
<tr><td colspan="5">Activity
4.3.1. Conservation breeding and reintroduction</td></tr>
<tr><td colspan="5">Task
4.3.1.1. Continuation of conservation breeding efforts</td></tr>
<tr><td colspan="4">Maintain Basistha conservation breeding facility in good condition and produce up to 20 hoglets every year. Transfer animals to other breeding and pre-release facilities to free up space at Basistha for better demographic and genetic management of the captive population at the site.</td><td>Review continuation of breeding at Basistha.</td></tr>
<tr><td>Expand the breeding facility at Potasali by adding a new low-maintenance enclosure complex to increase the total capacity of the centre from 2 to10 breeding pairs. Transfer 8 pairs of hogs from Basistha to the new breeding enclosure at Potasali.</td><td colspan="3">Produce 15-20 hoglets at Potasali every year and periodically transfer animals from the breeding enclosures to pre-release facility to maintain a demographically and genetically viable captive population at the site.</td><td>Review continuation of breeding at Potasali.</td></tr>
<tr><td colspan="2">Introduce one or two wild caught male founders into the Basistha captive population to improve its heterozygosity.</td><td colspan="2">Introduce one of two wild caught male founders into the Potasali captive population to improve its heterozygosity.</td><td></td></tr>
<tr><td>Identify a suitable site for the third captive facility, preferably in collaboration and financial support of another agency.</td><td>Establish the third breeding facility and build a couple of enclosure complexes large enough to breed up to 10 pairs of hogs and hold additional 30-40 individuals.</td><td colspan="3">Produce 15-20 hoglets at the third breeding facility every year and periodically transfer animals from this facility to pre-release enclosures at Potasali to maintain a healthy population of captive hogs at the site.</td></tr>
<tr><td colspan="4">Continue genetic studies on the captive stock. Focus on relatedness studies in order to select only genetically healthy and adequately heterozygous individuals for pre-release and release in the wild.</td><td></td></tr>
<tr><td colspan="4">Conduct disease vulnerability / susceptibility studies on the captive hogs in collaboration with College of Veterinary Science.</td><td></td></tr>
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<table>
<tr><th>2008</th><th>2009</th><th>2010</th><th>2011</th><th>2012</th></tr>
<tr><td colspan="5">Task
4.3.1.2. Reintroduction of captive-bred hogs in the wild</td></tr>
<tr><td colspan="5">4.3.1.2.1. Continuation of pre-release activities at Potasali to prepare captive bred hogs for release in the wild.</td></tr>
<tr><td colspan="4">Maintain and develop Potasali pre-release facility to prepare captive hogs for release. Keep the simulated grassland habitat in as natural state as possible. Heterozygous groups of healthy hogs to be provided by the breeding centre(s). The potential release stock to comprise of adult females (aged between 3 to 5 years old) with their litter of 3 to 5 hoglets, and adult males (aged between 2 to 4 years) in a ratio of one male for every two adult females. Keep a couple of these family groups (of 6 to 10 hogs) in each of the four pre-release enclosures under minimal human contact till they appear capable of surviving in the wild on their own.</td><td rowspan="4">Review pre-release protocol at Potasali and modify the strategy, if necessary. Continue to maintain the pre-release facility in good condition.</td></tr>
<tr><td>After the hogs brought in 2007 to Potasali are translocated to Sonai Rupai release site in the first quarter of the year, bring in 15 to 20 more hogs from the Basistha to Potasali to prepare them for release.</td><td>Bring 25 to 30 more hogs to Potasali in the year to prepare them for release.</td><td colspan="2">Bring 30 to 35 more hogs each year to prepare them for release.</td></tr>
<tr><td colspan="4">Monitor the behaviour and foraging habits of pre-release animals, including food preferences and activity pattern using direct observation and radio telemetry (put radio-harness on at least one hog in each group). Assess availability of natural food in the pre-release enclosures. Encourage them to forage and behave as naturally as possible, ensuring they visit the nestling ‘re-capture’ enclosure at lease once every morning by offering preferred food items in small quantities. Keep the hogs in the pre-release enclosure till they are ready for release, possibly for 4 - 5 months or a duration decided after initial trials.</td></tr>
<tr><td colspan="4">Instigate fear of natural predators, human beings and village dogs by replaying recorded pygmy hog distress calls on the pre-release animals being exposed to these dangers.</td></tr>
</table>

<table>
<tr><td colspan="4">4.3.1.2.2. Assist in habitat restoration, protection and monitoring of release sites in Sonai Rupai and Nameri</td></tr>
<tr><td colspan="3">Assist and advise the senior Forest Department authorities to incorporate good management practices for improving the grassland habitat at the release sites. These may include measure to prevent dry-season grass burning, livestock grazing, collection of thatch and other plants by the local villagers.</td><td rowspan="3">Review and modify the protocol for providing assistance to the Forest Department staff in managing the grassland habitat based on success of previous efforts.</td></tr>
<tr><td colspan="2">Help the trained frontline Forest Department staff in restoring, protecting and managing the grasslands at the release sites. (see under Objective 3 for details on training).</td><td></td></tr>
<tr><td colspan="3">Assess the impact of improved management and protection by scientific monitoring and surveys in the release sites</td></tr>
</table>

2008	2009	2010	2011	2012
4.3.1.2.3. Establishment of temporary release enclosures and monitoring camps				
Refurbish / repair the Gelgeli monitoring and protection camp in Sonai Rupai. Assist Forest Department in establishment of another protection camp in Sonai Rupai and a couple of camps in Nameri so that these can also be used as monitoring camps for released hogs. If necessary, raise funds for the purpose.	Help the Forest Department in maintaining the monitoring and protection camps in Sonai Rupai and Nameri.			
Establish a temporary release enclosure, large enough for a group of 8-10 hogs, at the Gelgeli release site in Sonai Rupai. Use a nestling 'recapture' enclosure inside the larger power-fenced release enclosure for supplementary feeding.			Review release protocol	
		Establish a temporary release enclosure, large enough for a group of 8-10 hogs, at the release site in Nameri. Use a nestling 'recapture' enclosure inside the larger power-fenced release enclosure for supplementary feeding.		

4.3.1.2.4. Release of hogs into the wild				
Ensure the hogs in the pre-release enclosure are fit to survive independently in the wild. Subject them to rigorous health check-up that are as non-invasive and non-restrictive as possible (e.g. thorough physical examination and pathological and bacteriological tests of their blood and faecal samples). Select only healthy hogs for release and recheck their identity (transponder number) before taking them to release site.				
Transfer 10 to 12 hogs from Potasali pre-release centre to the release enclosures in Gelgeli grassland of Sonai Rupai in two successive batches in the first quarter of the year.	Based on monitoring and other information collected in the first year from Sonai Rupai after release of the hogs, decide about the number and season of next release. If everything goes well, release about 20 hogs per year in Sonai Rupai in the second and third years of release.		Determine whether more hogs needs to be released in Sonai Rupai by analysing results of past releases, and if required, release another batch of hogs.	Carry out post monitoring assessment of the reintroduction programme and modification of protocols for better effectiveness
Transfer 10-12 more hogs in two batches to Sonai Rupai from Potasali pre-release centre in the fourth quarter of the year, if the hogs are ready for release in the wild.	Identify a couple of sites for release of hogs in Nameri. The habitat in both the potential release sites in Nameri need not be very similar to that in Manas and Sonai Rupai. One of the sites	Release 10-12 hogs in Nameri in the partly-wooded grassland site.	Release 20-25 hogs, 10-12 each at both the sites in Nameri.	

	could be 'sub-optimal' (e.g. partly wooded grassland) as it is sometimes pointed out that the last remnant population in Manas may not be using the most suitable habitat, which may have disappeared in the past.			
Put radio-harness on two hogs per group, including one on the group leader, if known. Monitor movement and activity pattern of released hogs and determine habitat use and preferences using radio telemetry.				

4.3.1.2.5. Survey of release sites for livestock disease risk and other potential health problems for the hogs			
Continue to collect blood and tissue samples from livestock in the fringe areas of Sonai Rupai and Nameri, especially those entering the PAs to graze or browse. Analyse the samples for any potential disease risk to the released hogs.			Reassess the disease risk and other potential health threats in the wild pygmy hog sites.
Take preventive measures by inoculating / vaccinating the hogs, and if necessary, selected livestock that could pose a threat			

Task 4.3.1.3. Identification of additional release sites		
Revisit some of the sites in western Assam, particularly in the newly accessible areas under Bodo Territorial Autonomous Districts and in bordering plains of Bhutan, to survey any site where grassland may have regenerated during the period of tribal unrest.	Initiate formal as well as community based conservation interventions at one or two sites with potentials for release of pygmy hogs, in lines with previous release sites.	Reintroduce pygmy hog if the grasslands
	If no suitable is site is found, explore if any site could be restored through adequate protection and scientific management by Forest Department, with help from civil society organisations of the locality.	If any suitable additional site is not found or restored in Assam, look for such sites outside the region.

<table>
<tr><th>2008</th><th>2009</th><th>2010</th><th>2011</th><th>2012</th></tr>
<tr><td colspan="5">Objective 2
Develop and assist implementation of habitat management plans in existing wild and proposed release sites; Monitor wild pygmy hog populations</td></tr>
<tr><td colspan="5">Activity
4.3.2. Grassland ecology and management studies</td></tr>
<tr><td colspan="5">Task
4.3.2.1. Document the floral and faunal composition</td></tr>
<tr><td colspan="3">Continue grassland ecology studies in Manas and initiate similar studies in Sonai Rupai, Nameri and any other release site, if identified. Record the floral associations and physical parameters (e.g. soil moisture) in different micro-ecosystems within the grasslands where the pygmy hogs exist or could be released. Prepare a vegetation map of the study areas using satellite imagery. Identify and monitor population and distribution status of some indicator species or community (floral or faunal) to determine the health of the habitat.</td><td></td><td></td></tr>
<tr><td colspan="5">Task
4.3.2.2. Determine the impact of existing and proposed management practices on the floral and faunal community of the grassland sites</td></tr>
<tr><td colspan="3">Redesign the habitat studies to include experiments to show the impact of annual dry season grass burning and livestock grazing. Undertake short (4 month) and longer term (3 year) field projects using M.Sc. and Ph.D. students. Document the impact of existing and proposed management practices on certain identified indicator species of the grasslands, including the pygmy hog, and on other natural inhabitants of the habitat.</td><td>.</td><td rowspan="2">Study the impact of any changed management practice based on the project’s recommendations</td></tr>
<tr><td colspan="4">Develop a system of controlled block burning and thatch cutting using fire lines, in order to mitigate the risk of hotter burns during accidental grass fires, to create a few openings in the thick grass, and to delay conversion of these successional grasslands into woodlands. Each of these blocks should not be burnt more than once every two years and adjacent blocks would not be burnt in the same year. Prepare maps to show the effects of scientific management vis-à-vis deleterious management practices on the grasslands.</td></tr>
<tr><td colspan="5">Task
4.3.2.3. Develop recommendations for scientific management of grasslands</td></tr>
<tr><td colspan="4">Based on the results of previous grassland studies and new experiments, develop recommendations for optimal grassland management and effective conservation of indicator species of the habitat, including the pygmy hogs.</td><td rowspan="2">Review the management recommendations based on their implementation and impact.</td></tr>
<tr><td colspan="4">Liaise with respective PA managers / Park Directors to implement the recommendations, at least on a trial basin in certain ranges or blocks, in order to demonstrate the benefits of scientific management of grasslands.</td></tr>
</table>

2008	2009	2010	2011	2012
Activity 4.3.3. Monitor wild pygmy hog populations				
Task 4.3.3.1. Sampling surveys				
Continue to conduct line transects in the grasslands of Manas to determine presence or absence of the hogs in different blocks in al three ranges of the Park				
Initiate block flushing experiments at sites with confirmed pygmy hog presence to estimate the populations more accurately.				
Task 4.3.3.2. Radio-telemetry				
Put radio-harness on 4-5 wild pygmy hogs and monitor their activity and habitat use in Manas. Recapture the hogs after a year or so to recover the tags.		Conduct radio-telemetry studies on additional 4-5 hogs after analysing the data from earlier experiment. Collect		

Objective 3 Build the capacities of relevant stakeholders, including Forest Department and select civil society and conservation organisations for enhanced protection, management and conservation of grassland habitat in the sites where the pygmy hogs exist or will be released				
Activity 4.3.4. Capacity building and advocacy				
Task 4.3.4.1. Enhancement of skills of Forest Department frontline staff for better monitoring of some key indicator species and their habitat				
Continue to conduct onsite wildlife monitoring training course for trainers and monitors (two 1-week workshops for 14 participants each every year)				Evaluate the capacity building and training efforts of the project and assess its impact.
Assist the frontline protection staff in monitoring the wildlife and the habitat for direct application in operational situations. Provide assistance and resource material to trainers for training additional frontline staff in wildlife and habitat monitoring techniques.				
Assist a couple of Forest Department staff nominated by the Park Director of each site in analysis and management of wildlife monitoring data collected by frontline staff. Provide computer hardware (one for each of the 3 sites) and software specially developed for the purpose by the Programme.			Extend similar assistance to new sites, if necessary.	
	Conduct refresher courses for accredited trainers and monitors incorporating newer techniques from other wildlife monitoring and training programmes (e.g. MIKE, tiger camera trapping census)			
Provide minor incentives to the frontline Forest Department staff in form of first-aid and medical kits, vaccines (e.g. against hepatitis), solar-power lighting, educational grants for children, etc.)				
Organise exposure visits by the trained frontline protection staff to better protected and managed PAs.				

2008	2009	2010	2011	2012
Task 4.3.4.2. Wildlife management and legal capacity building of Forest officials				
Conduct wildlife conservation management and law workshops for mid-level Forest Department officials (DFO, ACF and RFOs). The workshop will include modules on scientific wildlife monitoring for better park management, community relations, techniques for using wildlife law more effectively for better enforcement, crime scene investigation, and litigation (a 3-day workshop for 8-10 participants each every year).				
Task 4.3.4.3. Stakeholders' workshop on grassland management				
	Conduct a stakeholders' workshop on grassland management, involving the PA managers, senior Forest Department officials, civil society organisations, academic institutions and individuals working in the area or on the subject.			
	Get the recommendations and resolution of the above workshop incorporated in the management and action plans for the PAs with alluvial grasslands in Assam.			Assess implementation of the recommendations.
Task 4.3.4.4. Train trainers from select local CSOs (e.g. NGOs, youth clubs, schools) to undertake conservation awareness initiatives				
Continue to conduct training of trainers (ToT) workshops for school teachers and NGO members from fringe areas of Manas, Sonai Rupai, and Nameri (4-day workshops for 15 participants twice a year).				
The trainers will be monitored for follow-up action and teaching aids provided for creating effective awareness campaigns. Additional support may be given for conducting awareness generation programmes.				Evaluate the impact of awareness programmes organised by the trainers
	Organise field visits for trainers to demonstrate the importance of conservation.			
Task 4.3.4.5. Develop a training and community conservation centre at Manas to provide sustained support for capacity building activities				
Complete the establishment of training cum community conservation centre at Manas.	Establish a community facilitation centre for Manas fringe area community.			
Conduct training programmes and demonstration of community conservation alternatives				

2008	2009	2010	2011	2012
Objective 4 Initiate and sustain community conservation interventions in the fringe areas of the existing and release sites.				
Activity 4.3.5. Promote sustainable use of natural resources in the fringe area villages for reducing human and livestock disturbances and for direct economic benefit to the community.				
Task 4.3.5.1. Ascertain community's dependence on the wild grasslands and its need assessment				
Identify model villages around the release sites for planning of alternative livelihood options on pilot scale to demonstrate the usefulness and sustainability to the community.				
Socio-economic assessment of resource extraction use by community and need assessment to prioritise select interventions. These may include bee-keeping, fishery, food preservation, handicrafts, etc.				
Initiate entry-level activities in the identified villages as confidence building measure.				
Implement sustainable and alternative resource interventions. For example closely controlled thatch collection by community from defined patches (grass management incorporating the communities alongside patch burning). Encourage fodder, fuelwood and thatch plantations through awareness meetings and networking with relevant government departments (agriculture, veterinary, forest, etc				
Developing market linkages for community products through Durrell/other organizations				
Meetings with local political and youth leaders to advocate conservation of grasslands				
Preparation of community awareness material: Posters, education cards, theatre / plays, etc.				
Creating awareness among communities on the damage caused by unscientific burning.				
To reduce grazing pressure, develop linkages between livestock owners and veterinary care providers				
	Post-implementation assessment to evaluate the impact of community interventions.			
Task 4.3.5.2. Mitigate human-wildlife conflict				
Mitigation measures such as chilli smoke, chilli fencing, trip-wires, solar powered fencing and watch towers will be introduced to reduce human-animal conflict.				

2008	2009	2010	2011	2012
Objective 5 Raise awareness of the importance of conserving grassland fauna and habitats at the local, state and national levels				
Activity 5.5.2. Documentation and publicity of reintroduction activities and community interventions.				
Task 5.5.2.1. Documentation				
Documentation of the reintroduction process as well as community engagement activities.				
Task 5.5.2.1. Publicity				
The activities of the project would be publicized in local, and national newspapers, and television networks. Preparation of brochure on pygmy hog, including its endangered status, current conservation efforts etc.				

4.4. Future scope

Capitalise on opportunities presented to promote optimal biodiversity conservation activities in all relevant sites, including possibilities of initiating recovery / reintroduction plans for some other highly endangered grassland species such the hispid hare, swamp deer, Bengal florican, as well as some non-grassland species such as the whitewinged duck and golden langur.

4.5. Leading organisations and collaborating agencies

The Pygmy Hog Conservation Programme is a collaborative programme of:

- Durrell Wildlife Conservation Trust (DWCT)
- IUCN/SSC Pigs Peccaries & Hippos Specialist Group (PPHSG)
- Forest Department, Govt. of Assam
- Ministry of Environment & Forests (MoEF), Govt. of India

EcoSystems-India (ESI) manages the PHCP's operations in Assam. ESI is engaged in biodiversity conservation with special thrust on threatened and endangered wildlife and their habitats, and sustainable natural resources management. It was instrumental in launching the Manas Conservation Alliance in partnership with other local NGOs

The Chairman of PPHSG, William Oliver, has been instrumental in formulation of action plan for conservation of pygmy hog and initiation of the conservation programme in Assam. He continues to provide most valuable technical support and has also raised funds for the Programme (majority of the funds have however been raised or provided by DWCT).
The Assam Forest Department controls all the protected areas in Assam. Its role is to provide assistance during field research, status surveys and capture and release operations. It has also provided the land to establish the Research & Breeding Centre at Basistha, near Guwahati, and the Pre-release Centre at Potasali, near Nameri.
The MoEF's role is limited to policy inputs, but the Central Zoo Authority under the Ministry provides partnership in extension activities.

Wider partnerships have been developed with following stakeholders or organisations:

- College of Veterinary Science, Assam Agricultural University, Guwahati
- Zoology Department, Gauhati University, Guwahati
- Aaranyak, Guwahati
- Centre for Environment Education - North East, Guwahati
- WWF-India, Assam State Office, Guwahati
- Green Manas and Manas Bandhu Group, Bansbari, Manas
- Green Hearts Nature Club, Kokrajhar
- Natures Foster, New Bongaigaon
- Wildlife Trust of India, Delhi and Guwahati
- Zoo Outreach Organisation, Coimbatore
- Rhino Foundation for Nature Conservation, Guwahati
- Ashoka Trust for Research in Ecology and the Environment (ATREE), Bangalore
- Nature Conservation Foundation, Mysore
- National Centre for Biological Sciences (WCS Wildlife MSc Programme), Bangalore
- Centre for Cellular and Molecular Biology, Hyderabad
- Bombay Natural History Society, Mumbai
- Wildlife Institute of India, Dehradun
- Kalpavriksh, Pune
- Assam Science Society, Guwahati
- Regional Science Centre, Guwahati
- Botany Department, Gauhati University, Guwahati
- UNESCO World Heritage Site Biodiversity Programme

4.6. Budget: Estimated Budget for 4 year period: 2008 – 2011 (all costs in UK £)

SUMMARY	***2008***	***2009***	***2010***	***2011***
Capital costs				
Release sites (Sonai Rupai and Nameri)	20900.00		6600.00	
Pre-release Centre (Potasali)	18000.00			
Breeding Centre (Basistha & satellite facility)		5000.00	20000.00	
TOTAL	**38900.00**	**5000.00**	**26600.00**	
Operational costs				
Field sites (Manas, Barnadi etc.)	13280.00	13990.00	14770.00	15560.00
Release sites (Sonai Rupai and Nameri)	12960.00	16220.00	18850.00	19890.00
Pre-release Centre (Potasali)	13270.00	14210.00	14980.00	15770.00
Project HQ & Breeding Centre (Basistha etc.)	34300.00	36070.00	39730.00	41790.00
TOTAL	**73810.00**	**80490.00**	**88330.00**	**93010.00**

DETAILED BUDGET

FIELD SITES (Manas, Barnadi etc.)	***2008***	***2009***	***2010***	***2011***
Operational costs				
Fuel & Vehicle Maintenance	1540.00	1620.00	1710.00	1800.00
Telecommunication	390.00	410.00	440.00	470.00
Stationery & consumables	310.00	330.00	350.00	370.00
Maintenance of facilities (incl. house rent)	1540.00	1620.00	1710.00	1800.00
Equipment & maintenance	390.00	410.00	440.00	470.00
Travel, Per Diem & Honoraria	1250.00	1320.00	1390.00	1460.00
Meetings and Hospitality	310.00	330.00	350.00	370.00
Camping and field supplies	620.00	660.00	700.00	740.00
Technical Services	620.00	660.00	700.00	740.00
Insurance & Medical	770.00	810.00	860.00	910.00
Salaries	5000.00	5250.00	5520.00	5800.00
Contingency	540.00	570.00	600.00	630.00
Sub total	*13280.00*	*13990.00*	*14770.00*	*15560.00*
RELEASE SITES (Sonai Rupai and Nameri)				
Capital costs				
Vehicle 4-wheel drive	8300.00			
Repair of old protection & monitoring camps	2000.00		2000.00	
Construction of a new protection & monitoring camp	5000.00			
Furniture, solar power systems, camping equipment	2200.00		2200.00	
Tubewell, watertank, water supply systems	1000.00			
Electric fence for camps and release enclosures	1900.00		1900.00	
Binoculars and camera	500.00		500.00	
Sub total	*20900.00*		*6600.00*	
Operational costs				
Fuel & Vehicle Maintenance	1540.00	1930.00	2420.00	2550.00
Telecommunication	310.00	330.00	420.00	450.00
Stationery & consumables	160.00	170.00	220.00	240.00
Maintenance of facilities (incl. house rent)	1540.00	1620.00	2030.00	2140.00
Equipment & maintenance	310.00	330.00	420.00	450.00
Travel, Per Diem & Honoraria (incl. consultants)	1850.00	1950.00	2440.00	2570.00
Meetings and Hospitality	160.00	170.00	220.00	240.00
Camping and field supplies	620.00	660.00	830.00	880.00
Technical Services	620.00	660.00	830.00	880.00
Insurance & Medical	310.00	330.00	420.00	450.00
Salaries	5000.00	7500.00	7880.00	8280.00
Contingency	540.00	570.00	720.00	760.00
Sub total	*12960.00*	*16220.00*	*18850.00*	*19890.00*

PRE-RELEASE CENTRE (Potasali, Nameri)	***2008***	***2009***	***2010***	***2011***
Capital costs				
Vehicle 4-wheel drive	8300.00			
New enclosures	9700.00			
Sub total	*18000.00*			
Operational costs				
Vehicles Fuel & Maintenance	1080.00	1140.00	1200.00	1260.00
Postage & Telecommunication	310.00	330.00	350.00	370.00
Office Supplies, Photocopies & Consumables	160.00	170.00	180.00	190.00
Animal Maintenance	1850.00	1950.00	2050.00	2160.00
Maintenance of Facilities	1540.00	1850.00	1950.00	2050.00
Equipment & Maintenance	310.00	330.00	350.00	370.00
Travel, Per Diem, & Honoraria	770.00	810.00	860.00	910.00
Hospitality & Meeting Expenses	160.00	170.00	180.00	190.00
Technical Services & Publications	310.00	330.00	350.00	370.00
Insurance & Medical	1160.00	1220.00	1290.00	1360.00
Salaries	5000.00	5250.00	5520.00	5800.00
Contingency	620.00	660.00	700.00	740.00
Sub total	*13270.00*	*14210.00*	*14980.00*	*15770.00*
PROJECT HQ & BREEDING CENTRE (Basistha & satellite facilty)				
Capital costs				
Construction of a satellite breeding facility			20000.00	
Security fence for the satellite breeding facility		5000.00		
Sub total		5000.00	20000.00	
Operational costs				
Vehicle Fuel & Maintenance	3900.00	4100.00	4510.00	4740.00
Postage & Telecommunication	1470.00	1550.00	1710.00	1800.00
Office Supplies, Photocopies & Consumables	420.00	450.00	500.00	530.00
Animal Maintenance	4020.00	4230.00	4660.00	4900.00
Maintenance of Facilities	3660.00	3850.00	4240.00	4460.00
Equipment & Maintenance	1800.00	1890.00	2080.00	2190.00
Travel, Per Diem, & Honoraria	2640.00	2780.00	3060.00	3220.00
Hospitality & Meeting Expenses	600.00	630.00	700.00	740.00
Technical Services & Publications	720.00	760.00	840.00	890.00
Insurance & Medical	1800.00	1890.00	2080.00	2190.00
Field Expenses & Awareness Programmes	2400.00	2520.00	2780.00	2920.00
Salaries	9700.00	10190.00	11210.00	11780.00
Contingency	1170.00	1230.00	1360.00	1430.00
Sub total	*34300.00*	*36070.00*	*39730.00*	*41790.00*

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