Darwin Initiative Annual Report

Darwin Project Information

Project Ref Number	1516
Project Title	Habitat restoration and sustainable management of southern Peruvian dry forest
Country(ies)	PERU
UK Contract Holder Institution	Royal Botanic Gardens Kew
UK Partner Institution(s)	
Host country Partner Institution(s)	Universidad Nacional la Agraria, La Molina Lima Peru, Universidad Nacional Luis Gonzaga Ica (UNICA), ANIA Bosques de los Niños
Darwin Grant Value	£198,214
Start/End dates of Project	May 2006 – April 2009
Reporting period	May 2006 to April 2007
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Project website	www.huarango.org
Author(s), date	Oliver Q. Whaley, William Milliken 15th April 2008

1. Project Background

The project is located in the hyper-arid desert region of south-western Peru. The virtually rainless environment results in dry forest vegetation highly susceptible to degradation and desertification, with very infrequent natural regeneration. The region (Department of Ica) is home to over 600,000 people with few economic resources and a rapidly expanding agro-industry. These driving forces, in combination with lack of locally targeted environmental education, have had a devastating impact on native biodiversity.

Huarango (*Prosopis pallida*), originally the dominant tree species in the region, provides many food and forage products that potentially offer lucrative sustainable livelihoods. During the last 30 years there has been an estimated loss of 50,000 hectares of Huarango forest in the Ica region, with less than 1000 ha remaining (of which the majority is secondary forest). Huarango forest is an ecosystem is on the edge of extinction; a situation reflected by its national classification as threatened, and the increasing levels of concern among the regional government for its conservation.

The remaining natural vegetation is characterised by several unusual, highly threatened ecotypes, all of which are now poorly represented. These include riparian oasis *Prosopis* dry forests, Andean outwash fan dry-forest, cactus-rich scrub *bajadas*, marginal *Prosopis* coppice dunes, ephemeral streams or wadis and coastal lomas. Within these small relic habitats a number of endemic species, across a range of taxa, are still extant.

The project is addressing these issues through a combined programme of applied activities including: developing and disseminating technology for habitat restoration to protect biodiversity and combat desertification; increasing understanding of dry forest ecosystem dynamics and biodiversity; evaluating the capacity for increased production of native forest products (*Prosopis* pod flour and syrup) as sustainable economic options for forest use; protecting biodiversity of remaining native forest relics by buffering with restored habitats; raising awareness of the importance of south coast dry forests and associated biodiversity, resource values, threats and management strategies; and supporting the establishment of protected areas in remaining fragments of native dry forest ecosystems.

2. Project Partnerships

The project has continued to work with Universidad Agraria La Molina (UNALM) through its project MOU. Two master's students have produced excellent theses under the guidance of Dr Carlos Reynel. We are continuing to collaborate with a new Masters student from the faculty of Biology, Natali Ramirez, who worked at the Kew Millennium Seed Bank (MSB) during 2007 researching cactus seed germination. Nevertheless some challenges with continued UNALM student participation have been experienced, largely due to the distance of Lima from the project sites and associated costs and logistical difficulties.

Thus the project has strengthened its engagement with with local university (UNICA) students, both for meeting project research targets and for ensuring local uptake and application of skills by trained students. For example, the project is advising on the establishment of a small NGO to meet the increasing demand for biodiversity monitoring and habitat restoration from large agro-industrial producers. The project currently works with eight core UNICA students and 15 volunteer students from the faculties of Sciences and Agronomy. The core students have, through the project, now trained 37 others in botany and four in tree nursery management techniques. We have strengthened project links with UNICA through a MOU that commits to supporting development of a new herbarium and facilitating the long term (post-project) use of the project nursery for native plant production.

Kew has established a MOU with ANIA and GAP, two collaborating NGOs, in order to facilitate their developing partnership in educational tree planting and forest reserve management after the project finishes. Our relationship with ANIA has been further strengthened by brokering a funding partnership (£3,000 this year) with the London-based charity Trees for Cities (TFC) that will continue to support the educational planting activities initiated by the project. Furthermore, through TFC we have applied for lottery funding as part of the exit strategy which, if successful, would bring £15,000 per year to ANIA of which at least half would support educational planting activities.

Kew as an organization, under guidance from its new director Steve Hopper, has begun the challenging process of incorporating habitat restoration as a core institutional activity. The project will be included as a case study for the group of international restoration experts that Kew is drawing together in June 2008. Given the climatic and ecosystem similarities with arid regions of the southwest USA, we were pleased to host a visit from two professors of restoration ecology and plant physiology from the University of California (Karen Holl and Michael Loik) early in 2008. They were able to visit the habitat restoration sites and, over three days, provide useful advice and a small talk to some of the project students. The project has continued to maintain contact with the Society of Ecological Restoration (SER) and participated in a constructive live online group discussion on 25th April with David Bainbridge, author of *Desert and Dryland Restoration – a new hope for arid lands*.

Instead of the planned MSB staff visit in 2007, it was decided that the project would benefit by developing links and learning from the experience of the MSB project in the arid northern Chile. Originally planned for 2007, this visit was delayed and will take place during the last weeks of April and first week of May 2008. Ana Sandoval (National Agricultural Research Institute of Chile INIA) will provide capacity building in seed collection and management, reproductive biology and propagation techniques to UNICA students. The trip is timed to coincide with a the visit of Dr Fiona Hay from the MSB who will be undertaking the ambitious task of trying to germinate ancient seeds derived from INC museum excavations of pre-Columbian Nazca culture (2300 BP). This research opportunity was identified through the Darwin project fieldwork, where local charcoal burners and tomb robbers working have described spontaneous germination of ancient seeds derived from tombs. Fiona will be working with Natali Ramirez (UNALM), who will go on to work with the project in habitat restoration research on the agro-industry sites.

Governmental collaboration

Developments in governmental biodiversity protection in Peru, implemented by the APRA government of Alan Garcia (see also previous report), continue to affect the project's involvement with relevant agencies. The process of absorption of the two government environmental agencies CONAM and INRENA into a new Ministry of the Environment is expected within the next months, with associated personnel changes. In spite of loss of the relationships established by the project with these agencies, there may be some benefits. The North America Free Trade agreement (TLC), whilst likely to have a negative effect on agro-biodiversity, is compelling the government to impose stricter environmental regulations that may provide greater demand for the skills produced by the project in the field of habitat restoration.

INRENA will now be incorporated into the regional government, based within their offices but with more resources at its disposal. INRENA in Ica does not currently have a vehicle but is charged with control of illegal logging, often in collaboration with police. Its incorporation is a radical change which will allow it to access remote locations where logging is still taking place in forest relics.

The strong relationship the project has forged with regional government should contribute to sustainability. This year we have provided native species for government planting, set-up an official curriculum teachers workshop for protection and use of biodiversity, planned for 8-9th May (60 teachers) set-up with the support and ID card signature of the Regional Government President, and most recently organized the *Festival de Huarango y Naturaleza de Ica* in close collaboration with the government. The event was inaugurated by president Triveño and over 3 days was attended by over 800 school children (school lists available), 1700 general public with press attention from 9 journalists producing TV, radio and newspaper articles. The regional government collaboration has, for example, also facilitated provision of 40 years of local climate records from SENAMI that will provide key reference data for the restoration manual.

3. Project progress

Although the last year in Peru has been challenging, the project has remained on track. Key challenges faced included a devastating earthquake in August 2007 (8 on the Richter scale, killing over 500 people),[1] extreme summer temperatures and, recently, freak rainfall related to the *El Nina* phenomenon, causing fermentation of Huarango pod crops. Cecidomydae and Lepidoptera plagues have continued to cause die-back of large trees and to slow the growth of those planted.[2] Nevertheless, with the exception of journal articles that have suffered delays due to time-lag in the availability of experimental results, most activities and outputs are not only running to schedule but have been complemented by many unforeseen additions. The project continues to enjoy good relations with local communities, landowners and schools as well as government (see above). Involvement with the local university UNICA has expanded far beyond the extent originally planned, with a greater focus on involvement of undergraduate students and support for undergraduate theses. Conversely the engagement of Masters students from UNALM (see above) has been lower than envisaged.

The project is now benefiting from a strong, integrated team: there are currently 14 local people engaged in: sustainable production, education, germination, propagation, monitoring, restoration

[1] Staff from Kew and MSB donated approximately £1900 to project staff whose houses were destroyed in the earthquake, in order to help them rebuild.

[2] The Huarango Cecidomydae plague has now been Identified by OQW with help from Dr. Gagne (USDA). Its life cycle has been monitored and recorded in detail for publication (in prep.). Notably, this year for the first time, biocontrol agents such as *Chrysoperla* spp have been observed (and photographed) predating the Cecidomydae larvae.

and ecology research. This is a proving vital for the success of the project over its short time frame. Developing group enthusiasm for research and dissemination has been important for meeting project objectives but also for the practical skills gained in seed gathering, propagation and planting. Tree planting with children is an important component of these activities, both among communities and at the habitat restoration sites. These events (now more than 6000 plants) are team efforts, with planting often taking place at night to avoid the 40°C daytime temperatures. Thus the group, whilst undergoing training and capacity building and producing results for publication, is learning important teamwork skills and, most importantly; decision making.

3.1 Progress in carrying out project activities

Baseline information on biodiversity of forest fragments and degraded vegetation; use of forest resources

In December 2008 the long process of obtaining the first government Concession for Conservation (500 ha) of riparian oasis *Prosospis* forest was completed in the name of Grupo Aves Peru (GAP), with technical and financial support from the project. Fieldwork (see project biodiversity report) was completed by GAP in December, contacting all the local communities and beginning the preparation of the management plan for which the government allows 2 years.

The work in the concession has revealed some important biodiversity discoveries indicative of the lack of research and conservation in coastal Peru. Firstly, two probable new species: a new plant in the Cyperaceae family and a large beetle (Cerambycidae) which, with the female at 65 mm long, is one of the largest in western Peru. Male and female specimens, found perfectly preserved, have been lodged with the San Marco University Museum of Natural History (Dr Geraldo Lamas). In November 2007 Michael Dillon (Chicago Field Museum) visited the project and, as well as conducting research on the lomas flora, provided training to project students. He was able to confirm the rediscovery of *Nolana willeana*, not found since the collection of its isotype in 1960. Other highlights included the discovery of a large eagle owl, a species not previously known from southern Peru, and observations on the reproduction of the black-necked woodpecker and slender-billed finch (see biodiversity report).

The annual biodiversity report summarized the following: **1** the purpose and aims of the project; **2** monitoring of plants in restoration areas and succession plots; **3** plant collections throughout the year and botanical training; **4** avian monitoring and research; **5** ongoing project studies that including (i) *Inga* varieties and domestication in Ica, (ii) germination and propagation studies of Cactaceae, (iii) succession plot study; 6 resumés of scientific publications presented of in preparation; **7** educational tree planting in schools and communities; and **8** market research and product development. Report production provided an exercise through which local Peruvian project members could present their work as a team in a formal format that could, whilst informing ongoing project activities, be used to demonstrate their capacity to undertake interdisciplinary study to provide biodiversity expertise for the Ica region, monitor biodiversity and undertake restoration and environmental impact studies.[3] The work has been presented to some of the agricultural businesses involved in the project as part of the Darwin exit strategy.

The report did not cover the work of the two masters students from UNALM, whose theses (then ongoing) are complimentary to other project outputs: *Analysis of Flora and Phytogeography of woody plants of forests of the Region of Ica* (Gabriel Arango) and *Germination and Propagation*

[3] Building local capacity for professional-quality reporting is considered a significant part of the exit strategy. To help with this a two day workshop was convened in March with all the students and a language teacher from Lima, both to improve communication for publications, and facilitate useful contribution to the restoration manuals.

techniques of native plant species of Ica (Elisa Laura). Towards the production of the restoration manual we are currently collating detailed information on prior reforestation projects in the region of Ica including assessments of current status of the trees (size, health, root development) and collation of background information on planting, watering etc. This will allow us to learn from the successes and failures of these experiences. Work is also ongoing on the identification of herbarium specimens collected through project activities to date, which will be published as the first in-depth of the flora of the region.

In 2007 the project hosted a group of students from Newcastle University. As well as supporting ongoing project activities such as planting and monitoring, these students undertook research into local names of the native plants of the region.

The project undertook a GIS analysis comparing the US 1955 aerial survey with those of Google Earth 2007. With ground truthing data we were able to obtain some very useful information, both for deforestation rates and for rapid regeneration and growth rates, which we will publish in the manual and a scientific journal.

Tree nursery and seed handling/ propagation methodologies

The project has now established three small tree nurseries. As well as supplying the requirements of project planting activities, the main (Ica) nursery has been producing native plants to supply growing demand from the agro-industry sector, local government planting schemes and, recently, for a NGO child welfare charity. The nursery will also supply native trees for the ANIA-funded reforestation projects for which funding was brokered from Trees for Cities. This will fund reforestation in the reserve in Nazca which the project has helped to establish and in the surrounding communities under the ANIA Children's land project. In order to formalize the commercialization of the Ica nursery and secure its long-term future, a MOU has been established between UNICA and Kew. This stipulates that the nursery will remain dedicated to native useful and endangered species, linked to the seed collection and basic facilities of the seed laboratory in the Faculty of Agronomy.

We have also been asked to support the establishment of the Herbarium in UNICA Faculty of Sciences: the first for the region. The Faculty has donated a newly refurbished room to house the herbarium. The comprehensive duplicate specimen set generated by the project will form the core of this new collection, supplemented by reference materials from the small project library in the Ica office. Kew is now fund raising to buy cabinets and equipment.

In June and July the project was visited by Sandra King, an exceptional Kew horticulture diploma student who won a scholarship to fund her visit. The aim of the visit was to provide training in germination propagation and nursery practice, with a special focus on cacti germination. Prior to her arrival, the project set up a small nursery in the village of Huarangal on the land of the Anchante family, with the local school participating in watering and training.

Working with Octavio Pecho, Sandra helped collate the multiple enthobotanical uses of the cacti of the region and has since included this information into a leaflet for conservation and propagation of the region's cacti. This leaflet has been translated into Spanish but requires some illustration work and ecological notes for completion .

Production and processing trials and marketing of sustainable Prosopis pod flour and syrup

The sustainable management component has risen to the challenge of producing a high quality product despite problems with huarango pod production. The project has now completed market research and is this year collating information on historical production and annual production per tree age, variety and location. Despite the setbacks of *Prosopis* plagues and loss of crop from the *La Niña* rainfall event, production trials resulted in 200 kg of processed Huarango flour of which 130 kg is fine high grade sweet flour mesocarp, 40 kg touch bran endocarp (seed testa, exocarp, and 30 kg sieved endocarp granules. The trials were conducted with a recently opened German-run food mill. The first product was packaged in 150 gramme jars with Miskyhuaranga labels bearing the Darwin logo, producing about 600 labeled jars and 40 kg for the production of

cakes and biscuits. The sieved endocarp granules are for toasting to produce caffeine-free coffee substitute.

The Miskyhuaranga sweet meal product was launched at this year's huarango festival, together with a range of cakes, biscuits, ice cream and 'coffee'. All products sold well on the third festival day, with a sell-out of the trial coffee product. Miskyhuaranga company formation is planned with reinvestment of the product return and support from an outside investor. In the following months marketing trials will be conducted in the local and tourist outlets identified by the market survey. A database of huarango producers has been produced by Rino Cortez, and we are producing a leaflet for plague control and crop improvement next month, that will be incorporated into sustainable management manual. The Miskyhuaranga questionnaire and market survey results, some of which are in the project team report, complement this database.

From the 16-25 May OQW led a group from Ica to visit dry forest in Piura, Northern Peru, with the aim of providing training through workshops and site visits at sustainable use projects (see group report). The group comprised Consuelo Borda, Rino Cortez, Kati Alvarez Muzuaurieta, Enma Huayhuameza Cuba, Ana Palomino Lizarbe and Claudia Luthi. During the visit the different projects were filmed for the training video (Claudia). The group was hosted by Gaston Cruz at the University of Piura. The trip visited a range of projects and was able to learn a great deal, especially by the difficulties faced. The group visited 6 large producers of *Prosopis* (Algarrobo) based products such as syrup, flour cakes and coffee, and observed and participated in production whilst interviews were noted and filmed. Other visits included; pottery fired with coppiced Algarrobo; carpentry project, Ecobosque producing compost from cow dung, Algarrobo leaf litter to satisfy demand for organic fertilizer and a UN funded carbon sequestration project. This visit, although costly, has been deemed to be a highly valuable training experience. It was the first time the Ica group had been out of their region. They were very impressed by northern Peruvian dry forest and the existence of a wide range of sustainable management practice despite large problems and deforestation. Using the experience gained from this visit, the Miskyhuaranga group consolidated to produce a sustainable pod flour this year (see product report) supported by the project.

Due to the unusual river flow this year, the huarango may produce a good second crop of pods in June, that, providing the weather is not excessively humid and the product continues to sell well, will also be processed. However we have also identified several other sustainable products. The most hopeful is the production of is *Spondias purpurea* de-pipped raisins. At present the quebrada villages such as Huarangal leave the crop abandoned under the trees bordering raised flood-field borders. The dried fruits are sweet-sour, with a taste not dissimilar to dried cranberries. We are entering discussions with the German sweetmeal producer for development of an appropriate de-pipping machine.

We have also begun research (Charo Leon) into another sustainable forest product: painted carvings in *Salix humboldtiana* wood of the threatened birds of the region for the tourist market. There has been a small exchange of plant material produced by the project (*Indigofera truxillensis* – a blue dye plant) for woven dyed cloth with the weaving community (Fundacion AYU) in Cuzco.

Children trained in tree planting, aftercare and habitat regeneration

The project has now produced three educational posters (with Darwin logo) on the plants, birds and reptiles of the Ica area. These have been distributed within schools, communities, universities, regional government and INRENA and CONAM. Due to the imminent dismantling of both CONAM and INRENA we have been working closely with the natural resources team of the regional government to which these responsibilities will be devolved. However, as a result of meetings with CONAM Ica we received a large donation of environmental educational materials, some of which were given out as prizes during the festival and will supply our new 'Brigadas

Ecologicas' education programme involving 80 school children.[4] Educational planting has continued at 12 schools, with support a further four schools now engaged through the Fundo Chapi agro-industry. The planting events have seen a series of talks and workshops that are summarized in the annual biodiversity report. Approximately 1200 students and children have planted at least 1 native tree from 8 schools and 3 communities with 5 more schools included during 2008 (the city of Ica has over 200,000 children under 17).

On the 1st May 2008 we are planning, in collaboration with the regional government education department, a 2 day teachers workshop (*Nature of Ica – conservation and maintaining ecosystem* services) in the Instituto National de Cultura (INC). The course will be made official through the government and will be valid as a teachers' certificate – proof of ongoing training under the state system. The aim of the course is, for the first time, to provide teachers with the capacity to teach environmental studies tailored to local biodiversity and ecology. As well as presenting habitat restoration and livelihoods we will also cover climate change and the benefits of biodiversity for protection of soil, water, and regeneration capacity. The project will provide CDs and educational materials derived from the project. We will solicit feedback as to the best way to present the project's educational findings in the manual.

Increased appreciation of forest ecosystem/ livelihood value among local communities and government agencies

The third Festival del Huarango y Naturaleza de Ica. was attended by 15 schools, the general public, landowners and Pisco producers. The festival focused on the biodiversity of Ica, presented in a relaxed family setting with children's rides, story telling, poetry and music, environmental theatre, nature drawing competitions for children, and demonstrations of native seeds, huarango varieties and drinks made from huarango pods. The key educational theme was conveyed through banners (giantografia) covering the biodiversity and ecology of the region, threatened and invasive plants birds and reptiles. The event was widely publicized by the government press department and OQW was filmed inviting people to the event as well as five radio and four TV shows. It was reported twice in the *La Voz de Ica* and once in *El Correo* as well as *La Viajeros* of Lima, and in a documentary film directed by Delia Ackerman and Kati Huber.

During the pod processing activities we have been able to facilitate further training of members of the Cortez Family (Jovana Cortez, Flor Parco, Susan Patino) with Rino Cortez. Last year we worked with the Hernandez family, whom we continue to work closely with at the San Pedro site. The product was produced this year by four key producers that we have assisted in control of *Prosopis* plagues, two families of which attended the festival. We are preparing a leaflet to provide simple instruction on control of plagues and pod production improvement (this information will be included in the manual).

Manuals for habitat restoration in dry forests and sustainable production of Prosopis pod products and publications

Habitat restoration trials are now fully established in two village community settings (San Pedro and Huarangal) with differing *Prosopis* ecosystems, soils and altitudes. Two further trials have been set up in large Agro-industrial farms (Fundo Chanca y Fundo Chapi). Two plots were set up the monitor natural regeneration from Andean ephemeral stream flood collection, two last year in fundo Chanca and one this year in Pampa Yauca. The project has been approached by several agro-businesses, one of which (the largest agro-industry in Peru) has been selected for a final trial of techniques for use of sewage water in restoration.

Ostensibly tree growth in the agro-industrial sites has far outstripped the community sites due to inputs of nitrogen, more reliable watering and absence of grazing animals. However, we are now

[4] This innovative programme is designed to encourage pride among school children in caring for and understanding the environment.

undergoing a program of root excavation to obtain information on development and biomass. We are now cutting water regimes across the sites to understand the impact on survival and growth and the degree to which plants can derive moisture from fog capture.

Regular monitoring continues at all sites, supported by photographic records. The task of collating all the data necessary for the production of the restoration manual is ongoing. This is drawing on data from two graduate theses and two Masters thesis as well as biodiversity monitoring reports, ecological studies, germination and propagation trials, phenology data, *Prosopis* plague studies, archaeobotanical and historical ecology studies, monthly monitoring data, studies of previous restoration projects, native plant collection records etc. The project has accumulated a stock of images of most species of plants, birds and reptiles in the area which will provide a valuable resource for the manual. Development of information resources for the sustainable production manual is also ongoing, including historical records of Huarango use from questionnaire analysis, market research, huarango pod processing and products.

3.2 Progress towards Project Outputs

Overall progress towards project outputs has been good and in most cases exceeded expectations (see Table 1 and discussion of Activities above). The situation regarding loss of biodiversity in the region remains critical and the project remains unique to the area, representing a key opportunity to make a lasting impact and legacy to conserve and enhance biodiversity and livelihoods in the region. Indicators and measurables as outlined in the logframe remain valid. Educational outputs have exceeded expectations and are continuing to develop; likewise dissemination and public engagement outputs which are crucial for long-term success. Research activities have been delayed from the start of the project (see previous report), but are on track to produce the expected results and outputs within the coming year. Trials of sustainable forest products have met with challenges but are advancing.

The production of the manual for sustainable use of forest resources and the conservation and restoration guide are now key foci for activities. We are seeking additional funding in Peru to support the production of these outputs to a higher specification than would otherwise be possible.

The short length of time to produce results for habitat restoration is challenging. The project has identified important opportunities for additional restoration trials, beyond the original scope, that it has only recently been able to establish in the controllable, homogenous conditions of agro-industrial land. However, these represent significant added value for the project with positive implications for sustainability, and are therefore being pursued.

3.3 Standard Measures

Table 1 Project Standard Output Measures

Code No.	Description	Year 1 Total	Year 2 Total	Total to date	Total planned from application
8	3 UK project staff in Peru: OQW 31 wks, KG 2 wk, WM 2 wk	OQW 40, KG(TU) 2, WM 3	OQW 38, SK 3, WM 1	87	OQW 83 wks, KG (TU) 4 wks, WM 6 wks
2	Masters students graduate from Universidad Agraria		2	2	6
4A/B	Students UNICA; training/experience in nursery and seed management, germination techniques, landrace conservation - 24 wks each	4	4	8	6
4A/B	Students UNICA; monthly monitoring of restoration; ecology and biodiversity inventories	5	7	7	4
4C/D	Postgraduate students Universidad La Agraria; training/experience in habitat restoration techniques & biodiversity research – 31 wks each (Elisa, Gabriel, Alfonso Reategui)	3	3	3	4
6A	Landowners / employees receive training in habitat restoration with productive *Prosopis*	4	7	11	12
6A/B	GAP members trained in Avian biodiversity monitoring and botanical collecting and id	GAP 2, Bot 3	GAP 3 Bot 37	45	24
6A/B	Nursery staff receive training/experience	4		4	3
6A/B	1 Teacher from project area to train with ANIA (1 week)	1	1	2	1
6A/B	Tree planting, ecology & cultural use education with local school (14 days)	150	200	350	60
6A/B	Local families trained in *Prosopis* pod flour production (3 weeks each)	2	2	4	4
6A/B	Exchange/training visit of product stakeholders to Algarrobita project in Piura N. Peru (1 week)		6 persons 1 week	6	4
6A/B	Visitors from University of Piura Algarrobita project for demonstration (5 days)		2 day workshop in Uni. Piura		3
9/11A	Report of biodiversity assessments of restoration sites, (plant collection, bird mist nesting)	2	2	4	3

7	Project poster and roadside signs (Spanish and Quechua), leaflets for Huarango exhibition Museo de Ica (not yet in Quechua)	1	1	2	1
7	Training video; edited from filmed activities over project, film being made by Delia Ackerman		1	1	1
7	Educational poster for school classrooms and 1 leaflet	1	2	3	1
7	Habitat restoration manual (Spanish & Quechua) Conservation, Biodiversity and Restoration in Ica, Peru				1
9	Species action plans for key threatened species produced by GAP and included in Management plans and habitat restoration manual (Birds: Xenospingus,Colaptes,Geositta, Astenes spp.)			not submitted yet	4
9	Habitat management plan for restoration areas and buffer zones in Ica/Nasca		2 concession proposals	(2)	1
9	Huarango forest sustainable use manual (Spanish)				1
10	Annual report of biodiversity monitoring data from restoration sites	1	1	2	3
11B	Papers (minimum) submitted to peer reviewed Peruvian and international journals		2		4
12A	Project website; RBG Kew and Peru (Spanish) including research data	1		1	1
12A	Employment and participation records database	1		1	1
12A	Tree nursery inventory, seed provenance (map) and landrace database at UNICA	1		1	1
12b	Online databases enhanced with project-generated data: DarwinNet, CONAM, ABIS, LOMAFLOR (M. Dillon visited project in Nov 2007), Kew		1	1	4
13 B	Dry forest herbarium reference collections enhanced at		3	3	2
14	Huarango exhibition; products, culture and ecology show	1	1	2	2
14A	Papers and posters presented at National Conferences	2	2	6	0
14A	Workshop: local family training, forest protection and habitat regeneration.	1	1 festival and 1 Pisco producers workshop	1	2
14A	Workshop and stakeholder meeting of project participants	2	2	4	3
14A	Teachers workshop to incorporate Huarango ecology into schools		1	1	1

14A	Final project workshop				1
14A/B	Huarango products workshop, families trained by Samaca products		1	1	2
14 B	Public lecture and talks presenting project and results	5 OQW, 3 UNICA	2 OQW, 3 UNICA, 1 UNALM	14	0
15A/B/C	Local press articles; national press articles (per year)	4 local, 1 national	5 local, 1 national	11	5
15C	National press release UK (publication)	1 press release	2 long articles	3	2
17A/B	Project data included in DarwinNet, Kew project page and regional node for CHM websites		1	1	1
17B	Bosque de Niños restoration sites join ANIA Network (Lanchas, Sanitago, Poroma)		1	1	2
18C	Local TV report on project to highlight UNCCD year	2		2	1
18C	Local TV report on project results	1	1 spot	2	1
18C	Local and national TV report (independent film short)		1	1	1
19C	8 Local radio interviews/profiles per year	6	2	8	8
19C	Radio show to promote festival, with interview (Escuela Libre)	2	1	3	2
20	£13,600 including vehicle and processing equipment transferred to UNICA for community use (value not including wear/tear)				
21	Tree nurseries established: main at UNICA (8 x 30m); small at Pueblo Huarangal (4 x 6m), fundo Chapi (8 x 15m)	1	2	3	3
21	New Herbarium at faculty of Science UNICA		1	1	0
22	4 Habitat restoration areas established with designations, San Pedro Hernandez, Huarangal Anchante, Fundo Chanca, Fundo Chapi, AgroKasa SA (May 2008)	3	1	4	4
22A	Community reforestation projects	1	1	2	0
23	Sale of Huarango products (flour and syrup) estimated value equivalent to £1500; estimated value equivalent to £2500 per family		650 soles		equivalent value £4000
23	Additional funding for continuation of project activities		3500	3500	

Table 2 Publications

Type*	Detail (title, author, year)	Publishers (name, city)	Available from (eg: contact address, website)	Cost £
Journal	The Rôle of *Prosopis* sp. in Ecological and Landscape Change in the Samaca Basin, Lower Ica Valley, South Coast Peru (Early Horizon to the Late Intermediate Period) Beresford-Jones, Arce, Whaley OQ, Chepstow-Lusty 2007	American Antiquity, Washington, USA	The American Society for Archaeology	
Magazine	The Tree of life (interview with OQW about Darwin project). Olivia Edwards 2008	Geographical Magazine, London	Geographical Magazine	
Magazine	Messages from the Past. OQW 2007	Kew Magazine, London	Royal Botanic Gardens Kew	
Magazine	Peru Conservation projects, Rebeca Vaisman	Caretas,	Caretas	
Conference proceedings	Avances en la Restauración de hábitat y uso sostenible de los Bosques Secos del sur de Perú-Ica. Alfonso Orellana; J. Muchaypiña, M. Tenorio, E. Pérez, O. Pecho, F. Quinteros, F. Salvatierra, C. Gómez, C. Borda, O. Gonzales, C. Reynel & O. Whaley. 2007	IV Congreso Peruano de Ecología. Arequipa-Perú.	Revista DILLONIANA- Universidad Nacional San Agustín. Edición Especial Nov. 2007-5(1) Pág. 185	S/. 400
Conference proceedings	Caracterización ornitológica de tres hábitats para su restauración en la costa sur del Perú, Región Ica. Mario Tenorio, Evelyn Pérez y Octavio Pecho. 2007	IV Congreso Peruano de Ecología. Arequipa-Perú.	Revista DILLONIANA- Universidad Nacional San Agustín. Edición Especial Nov. 2007-5(1) Pág. 52	S/. 400
Conference proceedings	Flora desértica en el distrito de Yauca del Rosario, Ica-Perú. Octavio Pecho, O. Whaley, Merly Ormeño y Alfonso Orellana. 2007	IV Congreso Peruano de Ecología. Arequipa-Perú.	Revista DILLONIANA - Universidad Nacional San Agustín. Edición Especial Nov. 2007-5(1) Pág. 130	S/. 400
Conference proceedings	Semana por el Día del Ambiente. Alfonso Orellana García. Junio 2007	I Feria del Ambiente "Alberto Suárez"Lima-Perú	Universidad Nacional Agraria La Molina. Web: http://www.lamolina.edu.pe/eventos/ciencias/2007/ambiental/	S/. 100
Article	Nidificación del Pájaro Carpintero Peruano (Colaptes atricollis) en un agroecosistema de Ica, Perú. Octavio Pecho, Evelyn Pérez, Mario Tenorio, Oscar González y Oliver Whaley. 2007	Cotinga, Neotropical Bird Club U.K.	Neotropical Bird Club	

3.4 Progress towards the project purpose and outcomes

The habitat restoration sites are now beginning to provide the vital learning outcomes needed for the manual and for wider dissemination. It has been necessary to adaptively manage these sites using a variety of techniques. The context of the sites, in community and private agro-industry, has been very revealing in terms of understanding both the biological *and* social science needed for effective restoration. We have learned as much from our mistakes and failures as we have from our successes: this is an ongoing learning process.

The considerable project diffusion has engendered a wide public engagement and consequent project extension which is crucial to achieving the project purpose. For example communities such as FONABI, Tepro Ecologico and Guadalupe in the poorest parts of Ica have responded by requesting native plants from the project nursery. We have responded by providing a mixture of local native species and appropriate fruit trees. The presentation at the festival of a range of Prosopis-based products has generated a sea change both in the attendees and authorities of the region.

There has been some interest in the carbon sequestration aspects of our tree planting, including from Rio Tinto and TFC. We have not pursued this uncertain possibility beyond garnering limited funding through TFC (paid to ANIA for tree planting under a voluntary scheme). However we will be in a good position to produce some carbon accounting figures with biomass production for species related to conditions.

The partner organizations ANIA, GAP (La Rocha) and UNICA have all participated in native planting through the project, and are aiming to address desertification problems through species selection informed by the project results so far. Desertification has been a central theme to various workshops, and project members have presented results and ecological analyses of the processes in the Ica region, particularly regarding *Tamarix* invasion and soil salinity.

The areas of 'restored' habitat have seen promising results regarding biodiversity enhancement, with for example an increase of nine species of bird in the Fundo Chapi site since monitoring began as well as two lizard species in Fundo Chanka. Research suggests that biodiversity responds rapidly to the restoration corridor effect in these degraded linear ecosystems. In the hardest most degraded conditions however, the lack of recruitment has been disappointing during the first complete year, and it will take at least another three years to see large quantifiable changes that may be described as buffering adjacent forest.

3.5 Progress towards impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

See sections above

4. Monitoring, evaluation and lessons

Although this project maintains a strong focus on research-based development of techniques for habitat restoration and sustainable use, this will only result in achievement of the project purpose if public understanding of the benefits of such approaches can be raised and if active participation and uptake can be generated across a broad spectrum of society. Thus in terms of monitoring, we are maintaining a strong focus on measuring participation through schools, communities, businesses, local government, universities etc.

The lessons learned have been wide ranging. Examples include:

- Better understanding of the challenges and costs of non-local participation
- The need to integrate livelihoods benefits with habitat restoration in order to maximise community uptake and engagement

See also Section 6 for further discussion.

5. Actions taken in response to previous reviews (if applicable)

The points raised by the Darwin report have provided a useful tool and shown engagement with the wide aspects of the project, especially in the challenging environment of climatic and ecological change. The main concerns of whether the project will reach a stable and sustainable end point have been a particular focus of this year's activities.

Ongoing learning outcomes from the habitat restoration trials are being consolidated for publication to enable subsequent wide uptake by the increasing demand for the manual from local landowners, communities, schools, students and government. It is recognised that these will only reflect early-stage results within the project lifetime, and to complement this we have commissioned a retrospective survey of previous restoration attempts in the region.

It is also recognised that in terms of project legacy, it will be the processes rather than the products that are most important. Restoration trials naturally face an uncertain future once project funding ends, but we are helping to strengthen this by working with (and in some cases on the land of) groups with vested interest in ensuring their long-term success. The establishment of three reserves that will receive funding beyond the life of the project has been important for this process, as has our development of working relationships with agribusiness.

The Tunga concession, for example, has required the multidisciplinary involvement of the high-profile, active Peruvian NGO ANIA, and that of GAP. The San Pedro concession has seen the close involvement of the community, on behalf on which the concession is being sought. Both these areas will derive limited seasonal income from the production of Huaranga, and potentially ornithological tourism. Management plans are being prepared in close collaboration with the stakeholders. The Kew/Chapi MOU stipulates that the restored forest in the restoration area be set up as an *Area de Conservación Privada*, under the national scheme that protects the area beyond ownership change. This agreement demonstrates a willingness to protect local biodiversity and provide controlled public access for the local community (there are education regular visits from local schools).

Our approach to developing a long-term strategy for these conservation areas reflects the general strategy adopted by the project for delivering sustainable outcomes, i.e. building local partnerships, capacity building, awareness raising, helping to create demand, seeking sources of funding beyond the lifetime of the project and working with local government to influence policy. Thus, for example, a strategic decision was made to divert funding opportunities originally offered to the project (TFC, Big Lottery Funding), towards project partners, and to help formalise funding and working agreements between these organisations through memoranda of understanding.

The teachers and students project workshop supported by the government (and CONAM) planned for 16 May, will provide a critical input for and *by* the local schools (15 of which already participating) with educational materials provided on CD and booklet. This will allow teachers to continue to engage the project's Ecological Brigades and will be consolidated further by provision of the manual (seen as a teaching tool) and guide to execution of school and community reforestation and biodiversity enhancement, including management of livelihood species fundamental to long term uptake. Again, this process of engaging the education sector at a higher level and incorporating the lessons from the project's school-level activities is part of our efforts to maximise sustainability.

The habitat restoration sites have continued to provide the training grounds for the local students through monthly monitoring and planting. The watering and aftercare has been carefully monitored also but is largely untaken by the communities and landowners themselves (seen as essential for the engagement process and ownership). The positive impacts on biodiversity are reflected in increased levels of interest and enthusiasm among students and land owners, which the project will continue to encourage this year through dissemination (including manual) and site talks.

The community restoration sites have seen a number of changes to maintain the interest of poorer communities. The diminished growth of huarango is some situations (e.g. due to tree plague) has not galvanized as much support for these species as predicted. However, the project *has* developed a large demand from landowners for huarango seedlings that are supplied by the tree nursery at 25 cents per tree. This is seen as positive progress towards the commercialization of the nursery. The project has also started to introduce other trees with livelihood benefits such as pacay (*Inga sp.*) and the non-native but highly useful tamarind (*Tamarindus indica*). The small tree nursery of Huarangal, having produced plants including cacti for the restoration, is now being used by the Anchante family to produce local fruit trees for inclusion into the school, community and ameliorated conditions of the restoration site.

6. Other comments on progress not covered elsewhere

Some of the difficulties faced by the project this year, such as the earthquake, have already been discussed. This is a complex project with numerous inter-connected activities, requiring high levels of flexibility. This, coupled with unexpected issues such as severe mechanical problems with the project vehicle and other equipment failure, has put a significant strain on the budget that has been partially eased by capturing limited additional resources and local in-kind contributions. The involvement of large numbers of people in project activities, which has increased due to the greater engagement of local students and higher-than-expected uptake of some project activities, requires ongoing coordination. This challenge has been met by hiring a very competent local coordinator and implementing rigorous communication and reporting procedures. Engagement with local communities inevitably raises challenges, particularly in situations where their subsistence-level decision-making affects critical project activities such as watering programmes. In cases where this has had a negative impact on restoration trials we have learned to include such experiences into overall project learning. Working at the interface between conservation and sustainable development in an area of strong political complexity, particularly where vested interests of involved parties are obscure, also brings its own risks and has provided challenges for the project. This has been addressed by maintaining a very broad, open engagement policy coupled with an apolitical stance.

7. Sustainability

See discussion above (5)

8. Dissemination

- Conferences – see publication list.
- Websites – Kew, DarwinNet and Trees for Cities
- Darwin annual lecture (London): posters
- Posters for schools etc (see above)(
- Magazine articles (Kew Magazine, *Caretas,* Geographical Magazine).
- Meeting in the British Embassy – the future of forest conservation Dec 2007
- TV and Radio Peruvian local and national audience:

June 2007 (repeated filming April 2008) Filming the *King of the Desert is Dying* . Kati Huber and Delia Ackerman

17/4/08 Radio *Nuevo Luren* 8.00 am OQW 40 mins discussion highlighting project, activities, results and purpose.

17/4/08 TV *Canal 9 Universal Television* 9.00 am OQW 25 mins discussion highlighting project purpose, activities, results and huarango festival

18/4/08 Radio *Nuevo Luren* (Quiwi popular programme) 7.00 am OQW 40 mins discussion highlighting project, activities, results and purpose with final invitation to festival

18/4/08 TV *Canal 35 Sudameris*, 8.15 am OQW 30 mins discussion to highlight purpose of the festival and why we need the event in Ica

18/4/08 TV *Canal 15 Cadena Sur*, 9.10 am OQW 20 mins discussion to highlight the importance of the Huarango in the ecosystem of Ica, festival

18/4/08 Radio *Sistema* 12.00 am OQW 35 mins interview about project

18/4/08 Radio Pacifico with Lenin 12.00 am OQW 30 mins interview about project

20/4/08 TV National programa *Juntos* , OQW 40 mins filmed interview to highlight project activities and the loss of huarango biodiversity and culture

20/4/08 Radio Catalina, OQW 30 mins filmed to highlight project activities and the loss of huarango biodiversity and culture

- Dissemination activities in 12 schools in Ica region. Teachers conference planned 16th of May 2008.

- Huarango Festival

9. Project Expenditure

Item	**Budget (please indicate which document you refer to if other than your project application)**	**Expenditure**	**Balance**
Rent, rates, heating, overheads etc			
Office costs (eg postage, telephone, stationery)			
Travel and subsistence			
Printing			
Conferences, seminars, etc			
Capital items/equipment			
Others			
Salaries (specify)			
TOTAL			

- Office costs higher than planned due to difficulties with office accommodation originally offered to project (see previous annual report).

- Other costs higher than planned partly due to mechanical problems with project vehicle.

10. OPTIONAL: Outstanding achievements of your project during the reporting period (300-400 words maximum). This section may be used for publicity purposes

I agree for ECTF and the Darwin Secretariat to publish the content of this section

- Finalisation of conservation concessions for forest relics, in partnership with GAP and ANIA.

- Establishing the first Peruvian south coast Herbarium at UNICA.

- Developing models for integrating biodiversity enhancement into large-scale agro-industry: a first for the Ica region.

ANNEX 1 Report of progress and achievements against Logical Framework for Financial Year: 2007/08

Project summary	Measurable Indicators	Progress and Achievements April 2007 - March 2008	Actions required/planned for next period
Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but constrained in resources to achieve The conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources		Conservation concessions established, bidiversity improvement seen at habitat restoration trial sites, sustainable forest products produced and sold with benefits for local communities	(do not fill not applicable)
Purpose **Development and application of techniques for habitat restoration and sustainable use of native dry forest to combat desertification and conserve forest relics in southern Peru**	Habitat restoration trials established and learning outcomes produced Increased local awareness of huarango conservation importance, and engagement in research and project extension Active participation of partner organizations in habitat restoration & prevention of desertification Increased understanding and uptake of sustainable options for huarango forest use Areas of restored habitat buffering forest relics	Additional trial sites established, monitoring programmes continued Awareness raised through festival, workshops, educational activities, media and participation in project activities Additional local partners engaged Trial products developed and sold Conservation concessions finalised	Complete and disseminate learning outcomes Continue awareness raising Continue partnership building Explore and disseminate additional sustainable options, support production initiatives Final conservation concessions confirmed and long-term management agreed
Output 1. Baseline information on biodiversity of forest fragments and degraded vegetation; use of forest resources	Research undertaken; reports and papers produced (habitat mapping, bird survey, plant survey)	Much progress made with large amounts of data generated from monthly monitoring of restoration sites recording tree growth in mapped areas, bird observations – frequency, migration, site activity, seed dispersal. Lizard and ant observations are noted as good indicators of recovery and are recorded generally and within plots with other ecological observation (see monitoring form). Plant collections have been effective diversity indicators across the region with unusual La Niña conditions producing excellent flowering. GIS mapping has been difficult to differentiate fragments of Prosopis from invasive Tamarix and fruit plantation revealed by fieldwork, so maps must be produced manually. Wide range of reports available.	

Activity 1.1 Fieldwork and baseline research / monitoring		Ongoing plant collections of 400 specimens in triplicate, vegetation surveys, mapping of vegetation fragments in published thesis and mapping reports, analysis of aerial photography GIS Kew, further characterisation of small resource island communities (ongoing 2008). Monthly monitoring and inventories of avian (netting) and reptilian species. Extensive photographic record (6,000) of over 500 species of plants, 80 birds and 8 reptiles (databased). Interviews, questionnaires and fieldwork notes and photographs on use of forest fragments (published report). Monitoring costs have been high and now monthly monitoring has been reduced to every two months 2008. However, to obtain sufficient data monthly monitoring will continue in the agro-industrial sites.
Output 2 Tree nursery and seed handling/ propagation methodologies	Minimum of 8,000 seedlings of 3 major tree species & Prosopis land races established yr1 & 2	The first UNICA tree nurseries has produced to date 16,300 native plants of 21 key species, of which 6900 planted in restoration sites, 3400 schools and communities, and 6000 given out at festivals or events. Due to water shortages, school strikes, poor planting, goats and the earthquake there has been about 50% mortality in schools, 25-30% in restoration sites. Of those given out checks made have been surprisingly positive with one person with only 1 or 2 plants to tend, and an estimated 60% survival rate.
Activity 2.1 Establishment and management of tree nursery		Since the establishment of the UNICA plant nursery that has produced most of the plants, two more have been established. One in the higher elevation site of Huarangal, producing trees for restoration site and for germination of local cactus species with participation of the local school. The owner of the land has asked to produce fruit trees in the nursery and we will provide training in collection and germination techniques. The other large nursery at Fundo Chapi was recently constructed (under MOU with Kew) to produce trees to extend reforested corridor, long rooted seedlings for trials, childrens' education and visitors centre. Most seeds gathered last year have been used. The facilities are very basic for storage and the laboratory suffered earthquake damage in Aug 2007. The students first trained by Tiziana Ulian have qualified. Julio Quinteros is setting up his own tree nursery producing palm varieties but also native Prosopis. Andrea Padilla is working in a Fundo, as are two other students. The new project students Helver and Walter are working under guidance of Felix Quinteros and will receive training in May from Ana Sandoval (MSB project in Chile). Quantitative germination trials in 3 substrates have produced recorded techniques for 30 key species and published in master thesis of Elisa Laura and reports of Felix Quinteros. Seawater germination trials (in process) of Prosopis have shown significant germination in 50% seawater. Techniques of propagation through cuttings have been refined for species such as *Tecoma*, *Pluchea*, *Galvezia*, *Lycium* and *Salix* for which seed germination is slow or as yet unsuccessful.

Output 3 Habitat restoration trials buffering forest relics, using native species	Land use agreements and designation (ACP)signed; restoration areas established (2 yr1, 2 yr2)	Four restoration sites are now well established with land use agreements. There are highly variable growth rates due to differing circumstances. A fifth site will be established in May 2008 in order to trial sewage water as a low cost means of regenerating native vegetation.
Activity 3.1 Habitat regeneration research and dissemination		Four students (Alfonso Orellana, Marco Mendoza, Magaly Cuba, Octavio Pecho UNICA) are currently involved in monitoring and analysis of results. Octavio is training Magaly who will then work with Natali Ramirez (UNALM) to work and analyse results from trial sites in Fundo Chapi.
Output 4 Students and local land owners engaged in habitat restoration techniques & research	2 local students & 6 landowners/yr engaged in tree nursery & plots; 2 national postgraduate students in research (yr1)	Six students are engaged in monitoring the sites and producing reports analyzing data. Two postgraduate studies have been completed.
Activity 4.1 Habitat restoration research and monitoring		Students have been engaged in the establishment of new trial sites, including experimental design and planting. Monthly or bi-monthly monitoring has been ongoing including growth rates, mortality, fauna surveys etc. Data are processed by Anna Smyk (HP data analyst) and we have refined the monitoring forms to include a range of indicators, insect attack, phenology and ecological observations. Landowners are involved in irrigation and adaptively managing the irrigation problems. The large agro-industries have been increasingly responsive in line with the new Eurogap policies. Various small workshops have taken place with weekly discussions
Output 5 Production and processing trials and marketing of sustainable Prosopis pods flour and syrup	2 pod harvest and processing/sustainability trials running (yr1); market research completed (yr2); market trials (yr2-3)	Market research completed with market trials. A huarango sweet meal trial product has been processed and packaged for sale during the festival and after in several local outlets locally and in Lima. However production has been hampered by El Nina exceptional rainfall events in the first place in January causing loss of flowers and then in March much of the small crop was lost to an very rare heavy rainfall event.
Activity 5.1 Pod processing and sustainability research; market development		A German run (Sr. Walter Mick) company in Guadalupe, Ica recently established to produce process paprika, was found to develop and process the product. After initial trails it was decided to use a fine grade sieve in order to have a very palatable sweet and more soluble product. High sugar content in the huarango mesocarp was found prone to rapid humidity absorption, hindered the process and rendering the sweetmeal product lumpy or setting solid. Following a number of drying and processing trials a process has been found

		and an excellent collaboration has been developed with a planned written agreement. Most lucrative market seems to be the tourist market of visitors to Ica and Nasca Lines. A label has been designed to show the conservation benefits of the product and using the endangered Slender-billed finch with images of the forest and local community, as well as Nazca culture icons of plants and birds. The jar is relatively small (150 g) as this can be sold at 6 soles (£1) and is easy to travel with. Rino Cortez is collating data of huarango production per tree per age and per location and context. Miskihuaranga undertook interviews and questionnaires in the local areas where some huarango relicts are found.
Output 6 Children trained in tree planting, aftercare and habitat regeneration	1 school actively engaged in projects in local forest relic (yr1); 10 children able to train & disseminate (yr3)	Educational planting has continued to develop now forming Brigadas Ecologicas. These are the 10-15 most enthusiastic kids in each of the 12 schools. A methodology has been developed to train and support these children so that they can champion in school and community the tree planting and nature awareness, with emphasis on the importance and vulnerability of local biodiversity and plants to provide livelihoods.
Activity 6.1 Local education and capacity building		Identity cards for the Brigadas Ecologicas have been produced for 70 children, with support of the Regional Government Police, ANIA and Trees for Cities. Several of the most enthusiastic children each month are trained to be demonstrate tree planting and care; knowledge of the environment services and role of local biodiversity. This will be extended during 2008. Native species planted in capacity building events within school grounds and communities (900 trees and plants established). This will continue through 2008.
Output 7 Information network developed for SE Peru dry forest conservation, included in CHM	Education and dissemination available online and via partners	Reports sent to DarwinNet, and Kew website. Project publicity has seen notable response and traffic through the Kew Project pages
Output 8 Increased appreciation of forest ecosystem/ livelihood value among local communities and government agencies	Stakeholder meeting and workshops (annual); Huarango Festival (annual); 10 press and radio releases; 1 poster; 1 website	Workshops and capacity building 5 days training in botanical collection and native species. Weekly meeting and discussions have taken place with landowners during irrigation. The regional government has taken on the project as a partner and organized 2 training events and this year joined forces for the organization of the festival publishing the poster and T shirts designed by the project.
Output 9. Manuals for habitat restoration in dry forests and sustainable production of Prosopis pod products	2 Illustrated manuals produced and distributed (sustainable production yr2, restoration yr3)	Research is being compiled for the manuals. The structure has been developed collating idea from CR, WM and OQW.

Annex 2 Project's full current logframe

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Goal: **To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve:** • **the conservation of biological diversity,** • **the sustainable use of its components, and** • **the fair and equitable sharing of benefits arising out of the utilisation of genetic resources**			
Purpose **Development and application of techniques for habitat restoration and sustainable use of native dry forest to combat desertification and conserve forest relics in southern Peru**	Habitat restoration trials established and learning outcomes produced Increased local awareness of huarango conservation importance, and engagement in research and project extension Active participation of partner organizations in habitat restoration & prevention of desertification Increased understanding and uptake of sustainable options for huarango forest use Areas of restored habitat buffering forest relics	Field survey outputs and experimental monitoring reports Records of local project input/ participation; teaching records, numbers attending Agreements with partner organizations and reports of collaborative activities Local Ministry of Agriculture records; survey of huarango product producers Aerial survey and field data	Project retains support of government agencies and local communities Sustainable use trials prove attractive to local communities Climate change does not exacerbate uncontrollable desertification and drought or prevent successful restoration
Outputs Baseline information on biodiversity of forest fragments and degraded vegetation; use of forest resources Tree nursery and seed handling/ propagation methodologies	Research undertaken; reports and papers produced (habitat mapping, bird survey, plant survey) Minimum of 8,000 seedlings of 3 major tree species & *Prosopis* land races established yr1 & 2	Research data and reporting; annual monitoring outputs; publication records, Tree nursery inventory and provenance records; herbarium vouchers of parent material	*Permits for plant collection granted* Seeds available for planting

Habitat restoration trials buffering forest relics, using native species	Land use agreements and designation (ACP)signed; restoration areas established (2 yr1, 2 yr2)	Planting records & maps, 2-monthly seedling monitoring; biodiversity surveys; ratification of ACP	*Land remains available for habitat restoration trials*
Students and local land owners engaged in habitat restoration techniques & research	2 local students & 6 landowners/yr engaged in tree nursery & plots; 2 national postgraduate students in research (yr1)	Employment and participation records; University reports and supervision	*Local families remain committed to active role in project and support its aims*
Production and processing trials and marketing of sustainable *Prosopis* pods flour and syrup	2 pod harvest and processing/sustainability trials running (yr1); market research completed (yr2); market trials (yr2-3)	Pod production (kg) monitoring, production records, survey reports	*Huarango pod harvests do not fail; market outlets continue to demand* Prosopis *syrup and flour*
Children trained in tree planting, aftercare and habitat regeneration	1 school actively engaged in projects in local forest relic (yr1); 10 children able to train & disseminate (yr3)	School activity records and examination results; Club de Madres feedback, interviews	*School and Club de Madres remain open to participation with Bosque de los Niños*
Information network developed for SE Peru dry forest conservation, included in CHM	Education and dissemination available online and via partners	Review/monitoring of information portals; hits to website	Existing dissemination networks remain viable
Increased appreciation of forest ecosystem/ livelihood value among local communities and government agencies	Stakeholder meeting and workshops (annual); Huarango Festival (annual); 10 press and radio releases; 1 poster; 1 website	Project activity and output reports; meeting minutes; workshop feedback; media monitoring	Project partners and CONAM (as above) remain committed
Manuals for habitat restoration in dry forests and sustainable production of Prosopis pod products	2 Illustrated manuals produced and distributed (sustainable production yr2, restoration yr3)	Publication and distribution records; independent review of uptake and feedback	N/A

Activities	**Milestones**
Fieldwork and baseline research/ monitoring	Fieldwork completion & reporting of plant diversity and vegetation mapping of forest relics targeted for buffering with habitat restoration (yr1); report of avian diversity and forest use (yr1). Development of monitoring indicators (yr1); annual biodiversity monitoring (yr1-3).
Establishment and management of tree nursery	Seed storage and germination evaluation (May 2006); seed selection with provenance records mapped and databased, herbarium vouchers lodged with La MOL and SLGI (July 2006 and following yrs); tree nursery constructed & nursery staff contracted (Jul 2006); 8,000 seedlings of 3 major tree species & *Prosopis* land races established (Dec 2006 and subsequent yrs); nursery commercialization strategy developed (yr2).
Habitat regeneration research & dissemination	Research plots identified and land use agreements established (Sept 2006); students recruited (May 2006); fencing completed (Nov 2006), planting regimes and experimental plots established (Dec 2006); plots monitored (2-monthly); final research results compiled; research publications submitted (yr3); Dry forest habitat restoration manual produced and distributed (yr3).
Local education and capacity building	Collaborative agreement established with school (Jun 2006); school activities initiated (Nov 2006 and following yrs); educational poster/leaflet produced (Mar 2007); Huarango festival (Apr 2007 and following yrs); teachers workshops held (Feb 2007 & following yrs); schools' planting and education award scheme announced (Jan 2007). Students' visit to Prosopis Tamarugo regeneration scheme in Chile (July 2006).
National and international education and dissemination	Project website and DarwinNet portal established (June 2006); First radio broadcast (May 2006 & min. 6 per year); first press article (May 2006 & min. 3 per year), schools education materials incorporated into CONAM and GAP educational output (Feb 2008); Website integrated to National CHM CONAM (Sept 2008)
Pod processing and sustainability research; market development	Pod processing equipment procured (July 2006); pod processing trials commence in Nasca and Ica (Apr 2007); market research commences (Oct 2006); trials initiated (Oct 2007); Huarango pod product manual produced (Jan 2009).

Annex 3

Summary of restoration sites

Restoration site: ***Chanca***

The results for the Agro-industry have been very encouraging with Fundo Chanca showing some trees (*Schinus molle*) 3.8 meters tall after 16 months growth with sporadic drip-feed. The corridor site, along the margin of a denuded ephemeral stream, has been comparing plots planted under *Eucalyptus* windbreaks (established by the Fundo) and has seen of surprising rapid growth of native trees under eucalyptus. But the most impressive results is the development of a thick swath of vegetation. This is seeing increase in wildlife movement including the breeding of lizards such as the endemic subspecies *Microlophus thoracicus icae* and the red headed *Dicrondon heterolepis* lizards, normally only associated less disturbed sites.

Restoration site: ***Chapi***

The project has established a MOU between Agrícola Chapi S.A and Kew that sees the company designating a 6.8 ha of land strip of land (orientated along an outwash between the dry quebrada bajada and the Rio Ica) towards habitat restoration. The historical ecology of the area before the Fundo suggests a scrubby vegetation fed by nutrients and water from the Andean outflow augmented by fog capture.

Under this agreement the Fundo provides watering, infrastructure services and agrees to designate the area to conservation, whilst encouraging the participation of the local community and schools as a forum for habitat restoration education. The main aim of the project is threefold: 1. development restoration metrologies through comparative studies to test the effectiveness of N -fixation species, mulches (organic and rock), biodiversity and low biodiversity and irrigation techniques and quantities; 2. to demonstrate a corridor of forest regeneration and conservation of threatened plants and habitats with native biodiversity that visitors and local communities through which they are educated and stimulated. 3. to demonstrate the native species that can be used as hedges that provide for wildlife whilst providing crop biocontrol agents, but also with much reduced water demands, when compared to the non-native, invasive and widely used *Acacia karroo.*

Although only planted in August and September 2007 we are seeing some good plant establishment, plant recruitment, exceptional growth with low mortality rates. The use of vertical tubes (plastic bottles) compared to tree pit irrigation, with the same water regime, is showing a noticable difference in growth rates. At the same time initial results suggest very positive effects from the establishment of a series of bird perches and nesting habitats. As the winter fog season begins we are setting up fog capture trials through the use of plants and netting.

Restoration site: ***Agrokasa***

The agreement is presently being established with this agro-industry that supplies British supermarkets. The aim is to use 10 cubic meters of water weekly, to demonstrate effective plant establishment. We will compare plots planted with ecosystem framework species and plots of discharge only.

We have been recording the ancient irrigation techniques as a part of the project, and here aim to test the hypothesis that infiltration rates, and consequent plant establishment and root development, can be considerably improved using these changes in surface topography and swales (irrigation trench on contour).

Restoration site: ***San Pedro***

Compared to the agro-industrial sites both community context sites with public access have been challenging in terms of maintenance of irrigation regimes and water supplies. Small farmers in Ica generally cannot afford to donate limited productive land, which might be fed by seasonal flowing irrigation canals, but only marginal lands. In this site heterogeneous soil and aspect conditions require detailed site analysis of growth rates according to the mapped plants.

Furthermore the chronology of data must de linked to the information from the adjacent social and agricultural environment. In the San Pedro site the old hacienda pump (now owned by the cooperative following the Reforma Agraria), which we used last year, has broken and needs replacing. So the project has been obliged to tank in water from the seasonal river, and thereafter well water, to continue the irrigation until plants are sufficiently established with groundwater. We cannot repair the pump as it is outside the budget and must wait until the pump users can repair. Therefore here we also need to record changes to water type (with variable nutrients) linked to the monitoring data.

It is evident that open plantation-style restoration in sand dune conditions is not conducive to rapid growth or plant recruitment and that the adjacent intensively produced cotton crops encourage a range of damaging pests.

In order to adaptively manage these problems we have established alternative methodologies including: resource islands (close planting of sub-canopy ground cover species mixed with trees and shrubs, with buried mulches and dead cotton stems, bird perches. The aim is to provide niches for the observed biocontrol agents, attract seed dispersers and compare growth rates in these islands with improved microclimate and soil cover to the more isolated plants.

The site of San Pedro has a full range of aspect due to the topography and had allowed us to compare aspect as well as distance to relic forest across the range of species. Anna Smyk from Hewlett Packard has continued to help us analysis data across the range of sites.

Restoration site: ***Huarangal***

The site of Huarangal, at the foothills of the Andes, is associated a with cactus rich shrubs and Prosopis fragments indicative of a once rich system with highest plant diversity of the area, and a specialized associated fauna. The 2 ha site (belonging to the Anchante family) has been deforested and overgrazed for several decades rendered the shallow soil (overlying alluvial gravels) very poor soil with little structure or organic material. The main challenge here has been to engage the local community to maintain the water supply from a 30 m hand dug well, and use the river irrigation a few times per year when the river may fill a cut. A range of locally sourced seeds have produced some interesting results across a very variable landscape with a relic forest, glacial outwash boulders. Most plants here have shown poor growth rate and high mortality. However, we have good growth rates and a high level of recruitment associated with the relic vegetation with some of the recruited plants developing better than the same species introduced. Although an area was fenced it seems that this impedes irrigation somewhat, and migrating goats moving through the area have been a constant problem. We installed a small generator with an electric pump and have had a number of electrical problems from misuse of the generator. Subsequently watering involved a donkey cart, with the donkey being left to graze the site!

We built a small trees nursery, to trial cactus seed germination with a horticultural student on a scholarship from RBG Kew, and to produce cover shrubs from cuttings for introduction in the site. The local school (10 children) has helped with watering the tree nursery for which we provided Christmas presents. Groundcover shrubs like *Lycium* have shown recent successful cover and established and recent river water has seen improvement and establishment of the very slow growing *Capparis avicennifolia.*

Annex 4: Abbreviations and acronyms

ANIA	Association for Children and their Environment (Children land project)
CONAM	Consejo Nacional del Ambiente
GAP	Grupo Aves Peru
INIA	National Agricultural Research Institute of Chile
INRENA	Instituto Nacional de Recursos Naturales
MSB	Millennium Seed Bank Project, Kew
RBG KEW	Royal Botanic Gardens Kew
SENAMI	Servicio Nacional de Meteorología
TFC	Trees for Cities (London based charity)
UNALM	Universidad Nacional Agraria La Molina
UNICA	Universidad Nacional San Luis Gonzaga de Ica
USDA	US Agricultural Research Service (US Department of Agriculture)

Annex 5: list of additional resources

Posters and visual media

- Brigada Ecologica ID card example.jpg
- Brigada Ecologica poster.jpg
- Friend and foe poster.pdf
- Huarango Festival Poster.jpg
- Label for jars - huarango product.jpg
- Life cycles poster.pdf
- Ornithology poster (Congreso de ecología).pdf

Reports

- Annual Biodiversity Report.pdf
- Botanical training course report Feb 2008.doc
- Fundo Chapi social responsibility bulletin.pdf
- Fundo Don Ernesto bird report.doc
- GAP report on visit to Nasca conservation concession Dec 07.doc
- Native beekeeping report.doc
- Report on Miskyhuaranga production trial 2008.doc
- Report on Parque Ecológico Golda Meir (evaluation of previous restoration project).doc
- Report on visit to Piura.doc
- Report to Fundo Chapi abril 2008.pdf