

Darwin Initiative – Final Report

Darwin project information

Project Reference	15-010
Project Title	Buffer Zone Restoration and Development in Knuckles Forest Reserve
Host country(ies)	Sri Lanka
UK Contract Holder Institution	University of Aberdeen
UK Partner Institution(s)	Centre for Ecology and Hydrology, Banchory (CEH)
Host Country Partner Institution(s)	University of Peradeniya (UP)
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Project Website	www.abdn.ac.uk/knuckles
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1 Project Background

The project enhances conservation in Knuckles Forest, a site of high conservation value in Sri Lanka, by addressing threats through the development of options for buffer zone management that improve livelihoods of local communities and restore ecosystem function.

The project has four outputs: 1) options for rehabilitating degraded areas; 2) improved capacity to implement and adapt options over time; 3) empowered communities that articulate priorities and influence decision-making; and 4) recommendations for buffer zone management.

Outstanding project achievements include the engagement of multiple stakeholders in the development of recommendations and the incorporation of guidelines for *Pinus* conversion into policy.

2 Project support to the Convention on Biological Diversity (CBD)

In Sri Lanka, the Biodiversity and Natural Resources Division of the Ministry of Forest and Environment is responsible for the implementation of the CBD. The project contributes to the implementation of Articles 6 (General measures for conservation and sustainable use, 5%), 7 (Identification and monitoring, 5%), 8 (In-situ conservation, 40%), 12 (Research and training, 40%) and 13 (Public education and awareness, 20%) of the CBD.

Article 6: The project team supported national efforts to nominate Knuckles for the World Heritage List in 2008 and participated in the evaluation of the nomination in 2009. The new proposal to nominate Knuckles as a Man and Biosphere Reserve is being developed and the project outputs are contributing to the knowledge base for the nomination. The revision of the Knuckles Management Plan is underway, again informed by project experience and outputs; the Forest Department is seeking World Bank Funding to support the management in Knuckles and is using project outputs to substantiate the proposal.

Article 7: Our work characterising the vegetation and land uses in the buffer zone (Appendix 7) highlights the complexity within the buffer zone and the difficulties in applying the MAB concept of a buffer zone to Knuckles. The floristic value of a previously undocumented, small fragment of native forest, with high conservation value due to the number of endemic species, was highlighted in a publication and presentation by the project (see project website), as was the case for securing protected status for this fragment through provincial government.

Article 8: Recommendations for the management plan, for conservation of the ecosystems, for restoration of degraded lands, for stakeholders working in the region and for an operational framework were produced as an output of the project. These recommendations were derived from a workshop where stakeholders in the Knuckles buffer zone were broadly represented. The recommendations also were informed by research and training conducted within the project activities.

Article 9: A model was developed in the conversion of *Pinus* plantations, where ecological knowledge was applied to bring native species into cultivation; also, a model was developed where medicinal plants are incorporated into pine restoration. A demonstration site in Hantana was supported using project funds, and dissemination material was developed and distributed. The project team is providing training in nursery work to support trials with sandalwood and other medicinal plants to grow them in pine plantations. This work is integrated with a World Bank project on medicinal plants that developed propagation techniques and low cost nursery work with same project partners; this knowledge is being applied to the pine restoration work, continuity.

Article 10: We supported cooperation between the government and the private sector in community development by bringing agricultural extension support together with NGOs supporting organic agriculture to work with farmers and farmer organizations to develop new initiatives. Also, the UP partners through their work on the MAB nomination are integrating conservation and sustainable development into national decisions.

Article 11: The livelihood development activities conducted in traditional village clusters have used incentives such as access to markets for organic products to promote conservation farming. Also, the research and development activities conducted on private estates are linking conservation with incentives through interests in sustainability and certification.

Article 12: The project team was active in their research but also in the wider community, participating in numerous sub-national and national research conferences, stimulating the research division of the FD and feeding research findings into policy. For example, the FD policy for pine plantations, to shift from monocultures to expanding the plantations to more diverse and natural systems, was informed by capacity building workshops and dissemination material. The Knuckles region, specifically, the project implementation sites, are being used for students at school and university levels. Roadside guides and information pamphlets were produced and used in school visits.

Article 13: Locally, in Knuckles, the team undertook school visits to share experience and information with school children. Pamphlets were printed to cover the range of topics included in the project (see project website) and these provide the material to increase awareness nationally. The pamphlets are disseminated at relevant regional and national events by the project team and partners.

Article 14: Recognizing the risks posed by tourism in the conservation area, the government has gazetted the buffer zone as an environmentally sensitive area where new development will be restricted. By highlighting the biodiversity and socio-cultural values of the peripheral areas, we have contributed to this decision. Additionally, the Stakeholder Workshop held discussions related to this topic and the Vegetation Analysis in the Buffer Zone provides information and recommendations for minimizing adverse impacts.

Article 16: Through our collaborations with BioFoods and NGOs working on community development in village clusters we have promoted access to relevant technology (e.g., improved stoves, green manure and composting, organic farming).

In addition to the project's contribution to the CBD, there are cross-cutting contributions to national efforts to control invasive species. Project team members participated in the 6th National Symposium on Invasive Species (May 2009), contributing three research papers on *Pinus* and *Eupatorium*, and an invited paper focused on overarching issues.

3 Project Partnerships

UA and UP worked in partnership throughout the life of the project as the main implementing bodies. A Research Assistant from the UA, Mr Balram Dhakal, was based at UP and supported Pinard and Gunatilleke with project administration and coordination. The partnership established during previous collaborative initiatives (i.e., a British Council link and an EU-Asia Link Grant, with an existing MOU), however, during the Darwin Project, more and different staff at UP were involved, the integration across disciplines was enhanced, and previous research efforts were consolidated, utilized to develop training and dissemination material, and applied as recommendations to the Forestry Department for the management plan. The partnership is strong in the commitment from all sides to work together and to produce relevant, high quality outputs. It has been challenging to balance diverging interests with a limited budget, however, regular meetings and discussions helped us to address the challenge, along with a commitment to using funds efficiently.

Our partnership with CEH, Banchory, has principally been through the research component focused on the invasive pines in the buffer zone, and the training of a Sri Lankan MPhil student. The functional partnership is with Phil Hulme, who relocated to New Zealand at the beginning of 2007. This move was not detrimental as Hulme continued to provide support, in terms of scientific advice and training from his base.

Throughout the project we have worked with a number of other organizations in Sri Lanka, in various capacities. In the majority of cases the partnerships were demand driven as the awareness and need for the training, development options and networking support is broadly recognized.

The Forest Department (FD) holds responsibility for the management of the reserve and they were involved at the proposal stage (concept articulation, proposal writing), in the research planning and dissemination, in capacity building by supporting and participating in workshops and training events. They helped plan and played a major role in a networking workshop in Feb 2009 that brought together stakeholders from the Knuckles Region. Currently the FD is revising the management plan for the KCA and its buffer zone, and they have sought our input and utilised our findings and recommendations. During the early part of the project it was difficult to engage the forest department at all levels with the project, however, there has been demand for our research findings, recommendations for management and training materials. Members of the FD played important and active roles in the Stakeholder Workshop (Appendix 8), increasing the potential for the recommendations derived from the workshop to impact the process and content of the revision of the management plan.

The Provincial Government co-sponsored the Stakeholder Consultation Workshop (Feb 2009) in recognition of the importance of their involvement in the management of the buffer zone. Their district officers involved in planning and land use were active in the workshop, as were their team involved in tourism.

The IUCN was involved in defining the project concept and supported the project proposal. During the first two years of the project we exchanged information and experience with their Knuckles project on governance but during the third year, their involvement was reduced. The organization in Sri Lanka underwent some re-structuring and reviewing of their priorities. Their focus has shifted from governance to conservation and business; in 2009 they initiated planning new activities. The project team continues to work with them in the national efforts to secure World Heritage Site status for the Knuckles Conservation Area and Man and the Biosphere Reserve status for KCA and the buffer zone. IUCN is preparing a national red data book and project information, for example, on recently characterised wet forest fragment in the Knuckles Range will go in to the revision.

Private Estates and Private Landowners have been partners in the project from the beginning. Midland State Plantation and Finlay's provided sites for research and some infrastructural support. Individuals from Midlands and Finlay's participated in the Mid-term Review and representatives from several plantations participated in the Stakeholder Workshop (Feb 09). Amongst the private estates that we are working with, priorities for degraded lands differ. For some, the priority for the non-tea lands is fuelwood plantations to power their factories; native species are unlikely to provide the same output as exotics for this use. For others, there is interest in utilising some of these lands for community development projects for the estate workers. The collaboration between UP project staff and the estates will continue into the future.

We have working partnerships with several organizations that implement rural development in the Knuckles Region. In our community interventions we have been working alongside the national programme of *Jathika Sawiya* which is a NGO that supports sustainable agriculture. Representatives from that organization have worked alongside our team in community development, in terms of identifying training needs for farmers and in implementing training (e.g., composting and home garden improvements). Wickramasinghe (UP team member) joined their Board of Governors in 2008.

We are also working with an organization that supports small-scale farmers to move into organic production (Bio Foods (Pvt) Ltd). We collaborated on an assessment of farming practice and farmer motivation in the villages of Kalugala, Udailaka and Kosdanda, to determine whether or not it is feasible to promote organic farming in those areas. Several members of the team met with the Director of BioFoods in March 2008 to discuss shared interests and to identify potential avenues for collaboration. Subsequent to this, a cinnamon project was undertaken, with plants provided by the Agricultural Export Crop Division. This partnership was initiated by the project but is now embedded with the communities as the Export Crop Division is providing them with on-going support in monitoring and evaluation.

We worked with the Plantation Human Development Trust (PHDT), a state-funded social development programme targeting estate workers, in a participatory appraisal of sustainable development priorities in two estates. Although the appraisals were conducted and discussions about potential interventions were held, it proved difficult to implement activities that were interesting to all parties. Action was also delayed because of the economic downturn which reduced the financial resources for PHDT. Nevertheless,

discussion continues in relation to several estates where local interest was high. They are supportive of the planned developments but to date are lagging in terms of implementation.

During the third and fourth years of the project a quarterly newsletter was used to promote communication with our partners (see project website).

4 Project Achievements

4.1 Impact: achievement of positive impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

The project has contributed to the proposal prepared by the Ministry of Environment of Sri Lanka to nominate Peak Wilderness, Horton Plains and Knuckles for inclusion in the World Heritage List and also the Knuckles reserve as a UNESCO MAB site. Several key questions addressed by the DI project such as i) restoration of degraded ecosystem within the core-reserve area and the buffer zone and ii) livelihood improvement in the buffer zone communities, have been beneficial in strengthening critically important research areas under the 'logistic functions' of the MAB concept. The information disseminated through dissemination of pamphlets, local meetings, national and regional conferences and the project website have contributed to consolidate the proposal. The international recognition and protection associated with this status would go a long way in enhancing the project's positive impact on biodiversity. The impact of the DI project findings will be further realised in the form of inputs to the new management plan for the Knuckles Conservation area, which will recognise public-local community and private sector partnerships for sustained conservation management of the Knuckles Conservation Area.

The pilot projects initiated by the community livelihood development component has led to reduced demand on products derived from the Knuckles forest and market opportunities for value added products.

Private sector partners have translated our research on restoration to enhance productivity on degraded land on tea estates. This may result in enhanced incomes for estate workers and reduce illegal extraction of forest products from the protected area. Furthermore, one of the plantation companies involved in the DI project from the inception, Finlays Tea Estates Lanka (Pvt.) LTD have requested assistance from the DI project staff to assist them in the process of gaining a certificate of their plantations using Sustainable Agriculture Standards (SAN) developed by the Rainforest Alliance with particular reference to criteria on ecosystem conservation, wildlife protection, water conservation & soil management and conservation. This request came from the Finlays group primarily because of our partnership with them in their initiative for best practice plantation management.

Impacts on biodiversity will also be achieved through the future employment of project students and staff, translation of published scientific findings into practical techniques and raising the awareness of the importance of the site both nationally and internationally.

4.2 Outcomes: achievement of the project purpose and outcomes

The purpose of the project was to enhance the sustainable conservation of biological diversity and ecosystem services in the Knuckles Forest Reserve (KFR), Sri Lanka, by addressing the main threats to environmental protection through the development of options for buffer zone management that improve the livelihoods of local communities.

While it is still early to find direct evidence for enhanced conservation across the reserve, there is tangible evidence of an impact at local scales, with the likelihood of sustained expansion of positive impacts over the next decade.

Six communities have directly adopted restoration and rehabilitation practices during the life of the project. More importantly, the development committees within the communities have developed working relationships with a number of local service providers. During the course of the project, staff and students at both the postgraduate and undergraduate levels developed their capacity to evaluate problems, and adapt rehabilitation options to meet local needs.

Recommendations for the management of the buffer zone were developed jointly with other stakeholders and it seems that some have been integrated into the revised management plan but at this point, the draft document is not available for circulation. Unfortunately, the recommendation to make the revision process transparent and participatory does not seem to have been taken on board. Rather the first stage of the revision process has been undertaken by a small team within the FD, along with input from external consultants. As mentioned previously, the current strategy is to secure World Bank funding to

implement the revised plan and so current efforts are focused on the preparation of the application for funding.

There was broad consensus at the stakeholder consultation workshop about the need to develop an operational framework for guiding decision-making related to land use and development in the buffer zone. All agreed that there was a need for greater communication and formal structures and mechanisms to be put in place to allow the many community-based groups, non-governmental organizations, and governmental organizations with interests, experience and roles to play the management of the buffer zone to meet and share ideas and concerns. The Provincial Government and Forestry Department were tasked with pursuing this recommendation.

Although the project is officially finished, the project team continues to provide input to the national and regional efforts to secure the World Heritage Site and MAB nominations, and to work with the Forest Department on the revision of the management plan, with the Provincial Government in the implementation of recommendations for an operational framework to guide buffer zone development; also, the research sites are being maintained through minimum investment.

4.3 Outputs (and activities)

The project achieved the four outputs laid out in the final logical framework and all of the activities that were identified therein were completed. The original outputs were redefined after the first year of the project, supported by feedback from a mid-term review. In the following sections, each output is discussed in brief, reference can be made to Appendices 1 and 2.

Output 1. Options for the rehabilitation of degraded areas developed that are relevant to communities in Knuckles.

Rehabilitation and restoration options were identified by residents in traditional villages and estates in the buffer zone through participatory processes. A number of interventions were prioritized, planned and implemented by the members of the communities, with support from local service provision agencies. Market demand for new crops (e.g., cinnamon, organic produce) was explored through local NGOs and private enterprise.

In addition, research was conducted 1) on methods for restoring natural forest processes to cardamom planted forest, and 2) on the constraints to tree regeneration in degraded grasslands. The field sites established in this research are being used for training and education. In addition, the conservation benefits and livelihood potential of these options have been documented in pamphlets and disseminated through outreach activities.

Research was conducted that established the risks and negative impacts of *Pinus* expansion in the buffer zone. Experience with conversion of monocultures of pines to mixed species stands enriched with medicinal plants, food crops and timber species was used to develop training material and support existing field sites to provide demonstration models. Land owners and managers, including the Forestry Department and Tea Estate Managers, through their participation in project meetings, workshops and discussions, contributed to the development of targeted training and outreach materials.

Output 2. Improved capacity to implement and adapt options over time

The main focus of capacity building in the project was centred on staff and MPhil students at the University of Peradeniya, farmers and community members in relation to livelihood development options, and technical staff from governmental and nongovernmental organisations with an interest in restoration, rehabilitation or agroforestry development. Details of progress by activity are given in Appendix 1 and in section 4.6 below.

Output 3. Communities in Knuckles empowered to articulate their own priorities for livelihood options and to influence decision-making processes in KFR buffer zone.

Farmers groups and community development committees were strengthened through their engagement with and ownership over the process of appraising problems, prioritizing activities, planning and implementing activities and monitoring performance. There is evidence across village clusters of farmer to farmer sharing of innovations and information.

Farmers groups and representatives from communities with development projects, along with representatives from communities engaged with other NGOs and development projects participated in a stakeholder consultation workshop (Appendix 8) in February 2009. The workshop provided an opportunity for the communities to influence the recommendations put forward for the management plan for the buffer zone but perhaps, more importantly, provided a tangible, positive example of how structured discussion amongst the various stakeholders in the region can help to reduce conflict, enhance understanding and contribute to a sense of shared responsibility for sustainable development.

Output 4. Recommendations for management of the buffer zone of KFR

Recommendations were derived both from the research activities of the project team and from discussions amongst stakeholders during a workshop held in Kandy in Feb 2009 (Appendix 8). These recommendations have been disseminated to all participants in the workshop, project partners and all of the institutions represented at the workshop. In addition, members of the project team have met individually with the Forestry Department staff working on the revision of the management plan to discuss their recommendations for the buffer zone. The draft revision of the management plan has yet to be circulated for public review, we understand that our recommendations have influenced its form and content. The full set of recommendations from the stakeholder workshop is available in Appendix 8. These recommendations fall into three groups, those related to conservation, restoration and sustainable development (7 recommendations), those for stakeholders working in the region (18 recommendations) and those related to an operational framework (2 recommendations).

Recommendations derived from the project research activities all into four groups, those related to restoration and land rehabilitation efforts, those related to community development processes and those related to vegetation classification and land use in the buffer zone. These are elaborated in section 4.5.

4.4 Project standard measures and publications

Standard measures are quantified and described in Appendix 4. At the time of this report, all published material remains in the grey literature, as project documents, and is available through the project website (also Appendix 5). Several manuscripts in preparation present the main scientific findings and we expect that these will be submitted to appropriate journals during 2010.

4.5 Technical and Scientific achievements and co-operation

Research was integral to project activities and mainly related 1) to rehabilitation of degraded lands to restore and enhance ecological function and conservation values and 2) to livelihood development. The project purpose focused on the main threats to environmental protection. We perceived these to be the degraded lands within the buffer zone and the conservation area that hold little livelihood or conservation value and the lack of livelihood options for people living in the buffer zone.

Pinus Plantation Conversion or Enrichment with Broad-leaved Species

This work built on existing demonstration sites and experiments established near the University of Peradeniya (Hantana site) and near Sinharaja Forest Reserve. The aim of the research was to develop methods for converting monocultures of *Pinus caribaea* into mixed stands with native tree species, medicinal plants and multiple use species. The Darwin project contributed to this by supporting the maintenance costs for the Hantana site and by funding the production of training and dissemination material. This work was staffed by Prof CVS Gunatilleke and Prof IAUN Gunatilleke from the U Peradeniya, with support from the research students and their field staff.

The experiment at Hantana was established in 2004. A split-plot design with a factorial combination (two factors, light and slope) was replicated three times within a stand. The light factor included three treatments: partial shade, full shade and full light. A total of 2,659 tree seedlings were planted, from four species. Slope included lower and upper slopes. The experiment in Sinharaja was established in 1991 and was designed similarly but with variation in the levels within the light factor (4 levels, with one, two, three or five rows of pines removed). In this experiment late successional and mature phase canopy dominant tree species and gap colonizing non-timber forest species were used for stand enrichment.

The main findings of these experiments indicate that growth and survival of broad-leaved species varies with light treatments (i.e., the degree of pine removal) and that a large number of species can successfully be grown under and interspersed with *Pinus*. Also, it is clear that aboveground environments within *Pinus* stands can be manipulated to match the ecological requirements for plant species in different agro-ecological zones.

A number of peer-reviewed publications have come out of these experiments prior to this Darwin project. The main technical output delivered during this project period was the booklet containing guidance on implementation and the training materials developed for the Forest Department and other interested agencies.

Degraded Grassland Restoration

This research was initiated in 2002 under a EU-Asia Link grant to project team from UA and UP as doctoral research for Dr AMT Gunaratne and was developed by an MPhil student, Mr DW

Wickramarathna, The work has been supervised by D Burslem (UA), S Madawala (UP) and CVS Gunatilleke (UP).

Experiments were established in degraded grasslands 1) to examine how seed dispersal varies with distance from forest edge; 2) to compare tree seedling growth and survival in forest, at forest edge and in grassland; 3) to examine the role of root competition and soil nutrient limitation in the inhibition of tree development in degraded grasslands.

The results from this work indicate that seed availability is a constraint for tree establishment in the grasslands, high winds are probably responsible for restricting seed fall in the open areas. Forest fragments, however, are beneficial in that the edges are associated with higher levels of seed deposition. It may be that the forest serves to slow wind speeds, allowing seed to drop at the edges. Additionally, birds may be perching at the edges of fragments, bringing in seed with their droppings. The manipulation experiment with scarification of soil near the forest edge was effective at increasing tree establishment rates.

The results from the second set of experiments indicate that competition with grasses reduces tree sapling survival, and the strength of the effect varies by tree species. Herbivory did not affect growth or survival during the first year after transplant.

Two manuscripts are in preparation for this work (below) and pamphlets have been printed in English and Sinhala for dissemination. Components of the research have been presented in local, regional and national conferences.

Manuscript – Ruwan PMSA, Wijekoon P, Weerasinghe S, Gunaratne T, Burslem DFRP (under revision) Grass competition and herbivore effects on survival of transplanted seedlings on degraded grasslands in the Knuckles Conservation Area in Sri Lanka.

Gunaratne, A. M. T. A., Gunatilleke, C. V. S., Gunatilleke, I. A. U. N., Madawala Weerasinghe, H. M. S. P. and Burslem, D. F. R. P. (2010) (accepted). Barriers to tree seedling emergence on human-induced grasslands in Sri Lanka. *Journal of Applied Ecology*, XX, XX.

Gunaratne, A. M. T. A., Alexander, I. J., Gunatilleke, C. V. S., Gunatilleke, I. A. U. N., Madawala Weerasinghe, H. M. S. P. and Burslem, D. F. R. P. (20XX). Mechanisms of tree seedling survival and growth following transplantation into human-induced grasslands in Sri Lanka. *Restoration Ecology*, XX, XX. (in preparation)

Gunaratne, A. M. T. A., Gunatilleke, C. V. S., Gunatilleke, I. A. U. N., Madawala Weerasinghe, H. M. S. P. and Burslem, D. F. R. P. (20XX). Seed limitation in arrested succession on human-induced grasslands in central Sri Lanka. *Journal of Tropical Ecology*, XX, XX. (in preparation)

Wickramarathne, SDDW, Madawala Weerasinghe, S, Gunatilleke, IAUN, Gunatilleke, CVS and Burslem, DFRP. 2009. Post establishment barriers faced by four native tree species on degraded man-made grassland in Knuckles, Sri Lanka. National Geographic Symposium, UP, Peradeniya, January 2009.

Wickramarathne, SDDW, Madawala Weerasinghe, S, Gunatilleke, CVS, Burslem, DFRP and Gunaratna, AMTA. 2009. Seed availability: a limiting factor for the succession in degraded grasslands in the Knuckles Forest Reserve, Sri Lanka. International Forestry and Environment Symposium, Colombo, December 2008.

Wickramarathne, SDDW, Madawala Weerasinghe, S, Gunatilleke, IAUN, Gunatilleke, CVS and Burslem, DFRP. 2009. The effect of some biotic and abiotic factors for the establishment of *Macaranga indica* in grasslands in the Knuckles Conservation Area. Forestry Research Symposium, Colombo, March 2009.

Poster – the effects of root competition, soil nutrient addition and nurse plant establishment on the survival and growth of *Macaranga indica* in grasslands in the Knuckles Conservation Area, poster presented at the DI Project Stakeholder Consultation Workshop, Kandy, Feb 2009.

Invasiveness of *Pinus caribaea* into grasslands in the Knuckles Conservation Area

Research over the project duration was conducted by a MPhil student at the University of Peradeniya, WWWAB Medawatte, aimed at investigating the natural spread of *P. caribaea* from plantations into surrounding habitats in the Knuckles range, in relation to its seed production, ground cover, agro-ecological zone and anthropogenic fire. This work was supervised by K Tennakoon (formerly of UP, currently of U Brunei), Prof IAUN Gunatilleke (UP) and PE Hulme (formerly of CEH, Banchory, currently of Lincoln U, New Zealand).

The methodology involved field research in eight plantations in two agro-ecological zones. Habitats next to each study plantation were stratified into three belt transects (width 50 m) parallel to the plantation perimeter and mapped using Arc GIS software. *Pinus caribaea* that has spread into these transects

were recorded. Their growth stage, whether sapling, juvenile or adult (1-2, 2-4, >4 m height respectively) and density per ha were quantified and analyzed. Cone production gradient, seed and cone production, seed germination potential, wind effect on tree crowns and fire history of randomly selected *P. caribaea* plantations were investigated.

The findings indicate that grasslands adjoining the plantations are highly vulnerable to *P. caribaea* invasion compared to tea plantations, home gardens, scrublands and forests. *Pinus caribaea* trees grown on the perimeter of the respective plantations carried a significantly higher number of cones and were responsible for the bulk of the seed production in each plantation. There were no significant differences in the dispersible seed quantity per cone or the germination potential between the *P. caribaea* plantations in the two different agro-ecological zones. Local wind pattern has an important role to play in regard to the tree growth and seed dispersal of *P. caribaea*, presumably because of its effect on migrating seed density and long distance seed dispersal. Furthermore, factors such as variation in ground cover, soil erosion and fire regime in these grasslands also affects *P. caribaea* spread.

The research on pine invasiveness has been presented at several conferences and has been evaluated throughout the period by the student's thesis committee. The thesis was examined in Dec 09 and was passed by the committee. The manuscripts from the work are in preparation.

Medawatte, WWWAB, Tennakoon, KU, Hulme, PE, and IAUN Gunatilleke. In preparation. Seed and cone production dynamics of Caribbean Pine (*Pinus caribaea* Morlet) plantations and their contribution to pine invasion into grasslands in the Knuckles Range, Sri Lanka.

Medawatte, WWWAB, Tennakoon, KU, Hulme, PE, and IAUN Gunatilleke. 2008. Spread of Caribbean pine into the grasslands of the Knuckles Range (KR), Sri Lanka. National Symposium on Invasive Alien Species, Sri Lanka Foundation Institute, Colombo, November 2008.

Medawatte, WWWAB, Tennakoon, KU, Hulme, PE, and IAUN Gunatilleke. 2009. Role of seed and cone production of Caribbean pine plantations on the pine invasion into grasslands of the Knuckles Range, Sri Lanka. Peradeniya University Research Session (PURSE), 2009.

Cardamom forest restoration

Cardamom (*Elettaria cardamomum*) is an important export crop in Sri Lanka and a large proportion of the area under cultivation falls within the KCA. The research conducted in this component had two main aims: 1) to determine the effects of cardamom cultivation and management on forest structure and surface soil properties; and, 2) to evaluate suitable options for the removal of cardamom and the re-establishment of natural regeneration processes in the understorey of abandoned cardamom forest. This work was led by B Dhakal, the Project Manager, and supervised by D Burslem (UA), M Pinard (UA) and IAUN Gunatilleke (UP).

Methods for addressing the first aim included sampling of forest in three sites in KCA, where both plots were established in cardamom forest and natural forest for measuring soil properties and forest structure and composition. The second aim was addressed with a field experiment where eradication treatments were imposed (slashing cardamom, uprooting cardamom, maintaining the crop with cleaning and fruit harvest) and the response was measured in terms of seedling recruitment and growth.

The density of trees (≥ 5 cm dbh), saplings (≤ 5 cm dbh and ≥ 1.5 m height), and seedlings (≤ 1.5 m height) were higher in forests with a low density of cardamom relative to forests with a high density of cardamom, while stand basal area was marginally higher in the forests with a high density of cardamom. Canopy openness was higher in the cardamom plantation forests (35%) than in the low density cardamom forest (19%).

Soil pH and concentrations of total N and ammonium were higher in forests with a low density of cardamom, while concentrations of total P and exchangeable K were higher in the cardamom plantation forests and soil organic matter and concentrations of exchangeable Ca and Mg did not differ.

Of the total 740 trees sampled in forest with high densities of cardamom, there were 33 families and 68 species, whereas in forest with low densities of cardamom out of the 1853 trees sampled, there were 38 families and 77 species. Irrespective of the density of stems in the forests, species richness was higher in forest with low densities of cardamom (11 species plot⁻¹), relative to forest with higher densities of cardamom (9 species plot⁻¹). While comparing the accumulated number of species over the area sampled, we observed that the number of species was higher in forest with low densities of cardamom (77 species) relative to forest with high densities of cardamom (68 species), but the comparison of the species richness over the number of trees sampled indicated that the forest with higher densities of cardamom were more species rich than forest with lower densities of cardamom. The forest with low densities of cardamom had more diversity of species than the forest with high density of cardamom.

The pattern of species dominance was different in three studied sites, some species are predominant in one site while they are absent in others. However, *Calophyllum trapezifolium*, *Syzygium operculatum*, *Symplocos obtuse*, *Schefflera species*, *Turpinia malabarica* were the dominant species in the forest with

low densities of cardamom while *Macaranga indica*, *Neolitsea fuscata*, *Elaecarpus glandulifer*, *Turpinia malabarica*, *Symplocos cochinchinensis* were the dominant species in the forest with high densities of cardamom. Many species were common to both forest types, but some species were tended to be specific to forest types representing the different groups of plants adopting in different environmental conditions. The density of cardamom is one of the related factors determining the distribution of species.

The forests with higher densities of cardamom do not appear to have recovered substantially over time, even in the absence of major disturbances after the abandonment of cardamom cultivation for more than a decade in Knuckles forest, which evidenced that it will take a long time to get the forest recovered to its natural state.

About 12 months of data have been collected from the field experiment examining cardamom eradication but only preliminary analyses have been done to date. The preliminary findings suggest that treatments involving relatively severe disturbance to the soil (e.g., uprooting the cardamom) effectively reduce subsequent cardamom densities but also stimulate the establishment of weedy herbaceous species. Recruitment in plots in both natural and cardamom forest was dominated by herbs but cardamom but not common.

International Forestry and Environment Symposium (27-28 Dec 2008) in Colombo

Manuscripts in preparation:

Dhakal, B, Gunatilleke, IAUN, Pinard, MA and Burslem, D. Effects of cardamom cultivation on forest structure and species composition in the montane forest of Knuckles Forest Reserve of Sri Lanka. Forest Ecology and Management

Dhakal, B, Gunatilleke, IAUN, Pinard, MA and Burslem, D. An overview of cultivation and management of cardamom in forest understorey in Knuckles region and its potential ecological consequences. For the Sri Lanka Forester

Conservation implications of homegarden agroforestry systems

The buffer zone of KCA is a mosaic that includes manipulated land use systems that are culturally and socio-economically important (e.g., paddy fields, sugar palm stands, homegardens), manipulated systems that pose a threat to the ecological functions of the area (e.g., pine plantations), as well as degraded lands with little conservation or livelihood values (e.g., abandoned tea estates, grasslands dominated by exotic species). In order to develop management guidelines for the buffer zone, information is needed about the conservation implications of the manipulated land use systems. This research was conducted in a cluster of traditional villages in the buffer zone of Knuckles Conservation Area to address the following objectives: 1) to understand factors that influence household decisions to conserve and manage trees on privately held land; and, 2) to identify the conservation implications of the homegarden agroforestry systems. In addition, the following subobjectives were also investigated: 1) to identify the major agroforestry systems and the spatial variation in relation to forest and forest functions; 2) to examine the structure and composition of the trees and crops in the agroforestry systems; 3) to identify the contribution of traditional knowledge and traditional practices that help to reduce pressures on the forest, as well as the prospects for these practices in the future; 4) to identify locally acceptable measures that would improve the environmental and socio-economic benefits derived from the traditional agroforestry systems. This work was lead by DGAPIK Abeywardana, under the supervision of A Wickramasinghe (UP) with support from EHGC Pathmasiri.

Primary data were collected using participatory methods, field observations, field measurements and a questionnaire survey. Details of the methodology used can be found in the abstracts and details posted on the project website.

The main findings related to the first objective given above are that people base their decisions about trees in consideration of firstly, economic benefits, as the contribution of the trees to the household income; secondly, livelihood security, where the trees provide multiple goods and services relevant to household survival; thirdly, for environmental benefits, where people value natural regeneration and enrichment of their lands with trees; and fourthly, for traditional food habits. These findings are relevant to the design of future innovations involving the mobilization of local capital and facilitating community-based actions in the buffer zone.

The main findings for the second objective indicate that both forest and non-forest species are maintained in homegardens, with the majority of the forest species that are planted are used for timber, fuel and/or medicinal purposes. Transects examining tree densities and composition from the edge of the conservation into the village lands indicate that tree abundance in the landscape is weakly related to distance from the edge of the conservation area but tree species richness increases as one moves away from the forest, with manipulated systems being more species rich, particularly with multiple use, non-forest species. The results from this study indicate that many of the manipulated lands within traditional

villages are relatively species rich and dominated by trees and therefore are likely to maintain many of the ecological functions associated with forest systems.

The research on agroforestry practices and conservation values has been presented at several conferences and has been evaluated throughout the period by the student's thesis committee. Abstracts from the presentations are posted on the project website. One manuscript is currently in preparation.

Abeywardana, DGAPIK. 2008. Conservation implication of homegarden agroforestry systems: a study of the Knuckles Periphery. Peradeniya University Research Sessions (PURSE), Dec 2008.

National Geography Conference, January 2009-10-16 Abeywardana, DGAPIK. Conservation implications of agroforestry systems: a study of the Knuckles Periphery.

Wickramasinghe, A, Pathmasiri, EHGC and Abeywardana, DGAPIK. 2008. Motives of the Rural Communities in Agroforestry: A Policy Guidance in Buffer Zone Development: A Case Study in Udailuka. Thirteenth International Forestry and Environment Symposium 2008 – 27/28 December 2008.

Livelihood development

Alongside the project activities surrounding the development of livelihood activities for villagers and estate workers living within the buffer zone, research was conducted to address the following objectives: 1) to develop livelihood models to reduce forest dependence and to introduce conservation-compatible development through partnerships between local people and other stakeholders; and, 2) to characterise the types of forest dependence found amongst people living in traditional villages in the buffer zone with an aim to understanding how this dependence relates to other livelihood options. This work was lead by Prof Wickramasinghe (UP) with support from DGAPIK Abeywardana (UP) and M Pinard (UA).

For the first objective, several innovations were made by engaging local communities in integrating conservation into livelihood development in 3 villages; Kalugala, Kosdanda and Udailuka (KKU), where around 145 households exist. Strategic interventions were made to enrich existing homegardens; the riparian areas; and to convert the underutilized and unutilized shrub lands-the abandoned 'chenas' to productive systems through agricultural commercial development. The people were engaged through a participatory process, which is designed in response to their needs and problems, with the interest of addressing the livelihood risks and their vulnerabilities to external changes. The development of local resource-based livelihood, which depends on land, was the primary concern of the people to reduce their vulnerabilities to external changes and lack of access to the forest resources that they have used.

The preliminary analysis reveals that the community-based initiatives and the partnership framework, allows a substantial cost savings. People's commitment to continue, and their capacity to work with external agencies are central to livelihood development in the forest buffer. The results demonstrate that agricultural commercialization picks up by the communities very quickly and it is extremely effective in mobilizing local capital and empowering people. Comparative analysis of social, economic and environmental benefits of various options using indicators showed that agricultural commercialization is the best option. This paper demonstrates that livelihood development is a creative approach to buffer zone development over a range of sites and communities, which differ in their context and interest. The advantage of internalizing the process through the existing community organizations and building social capital focusing on buffer zone development lead to evolve focus oriented communities for orchestrating, effective coordination and implementation. Experience gained by replicating the process and the approach to other areas and also to the communities of the forest buffer demonstrates the wider potentials that are to be captured with desirable institutional and operational mechanisms.

For the second objective used a participatory approach to unravel the issues of forest dependence that affect the management of KCA and the development of its buffer. The work was conducted in Kalugala, Kosdanda and Udailuka (KKU), in a mosaic of villages located in its South-eastern periphery adjoining the Knuckles Conservation Area (KCA). Two hypotheses are used in analyzing the field information. The first hypothesis suggests that forest dependence is associated with a broader livelihood context which is marked with multiple requirements. The second hypothesis suggests that the allocation of labour on forest resource extraction, gathering and utilization is governed by availability of alternative sources and the traditional practices, but not merely by direct economic benefits. For detailed analysis field information was gathered through a questionnaire survey conducted in the KKU covering all 145 households in the mosaic, and using participatory methods engaging people in the research.

The field information revealed that 80 to 88 percent of the households are engaged in forest resource gathering, extraction and utilization. Villagers use forest resources as a material source for cash income, subsistence, and to meet their occasional needs and village based activities. The labour allocation on forest resource extraction and gathering shows that opportunity cost of labour is exclusively high in regard to all types of non-timber forest products and the value of labour does not decide the

engagement of these communities in forest resource utilization. The findings reveal that forest dependence is featured by three factors. The first is the promising market potentials for forest products and the reliability of forest resources for income generation. The second is the continuous interest in engaging in forest resource based economic activities. The third is the non-availability of options to obtain material to satisfy material requirements to meet some special requirements. These findings suggest that local communities can be organized as effective stakeholders in relation to their engagement in forest resource utilization to share the responsibility of management of KCA while investing in promoting alternative measures to reduce the pressure on forest.

Abstracts from conference presentations, the manuscripts will form publications in due course.

Wickramasinghe, A, Pinard, MA, and Abeywardana, DGAPIK. 2008. Alternative livelihood approaches for developing the buffer zone of the Knuckles Conservation Area (KCA). Thirteenth International Forestry and Environment Symposium 2008, Kandy, 27/28 December 2008.

Wickramasinghe, A, Pathmasiri, EHGC, and DGAPIK Ageywardana. 2009. Forest resource dependence for enhancing social responsibility over forest management and buffer zone development. Forestry Symposium, Colombo, March 2009. Thirteenth International Forestry and Environment Symposium 2008, Kandy – 27/28 December 2008.

Vegetation Classification

A classification of vegetation and land-use in representative areas of the buffer zone of KCA was undertaken to contribute to establishing a baseline and for informing the development of a management plan. An analysis of aerial photographs was conducted to address these objectives: 1) to produce an overview of the vegetation and land use types that exist in some selected areas; 2) to represent the characteristics and the nature of human activities expressed by the vegetation and the land-use; 3) to examine the contextual conditions influencing the boundary of the KCA by superimposing the delineations to vegetation or land-use types, and two contours; 2559' and 3478's.; and, 4) to stimulate discussion on the interactive effect of development focusing heavily on vegetation and land-use of the buffer area for sustainable management of the KCA. This work was lead by Prof Wickramasinghe with support from Mr EHGC Pathmasiri and Ranjith Wickramasinghe.

Nine sites were selected for the analysis based on a comprehensive analysis of the longitudinal profile of the area, including criteria relevant for the nomination of the reserve as a MAB reserve and the requirements for World Heritage site designation. In addition, site selection was constrained by availability of cloud-free aerial photographs and accessibility for ground-truthing. Field data were gathered by visiting the sites and collecting GPS reference points. Vegetation classification was done using a posterior approach that is described in Appendix 7.

The findings indicate that there is substantial variation in the dominance and distribution of land use types across the areas examined. The fringe of the forest is highly dissected in some areas and in other areas, manipulated land use systems are situated outside of forest land.

The manipulated land-use systems differ in terms of their size, conditions and the risks that they pose to the conservation values of the core area. The impacts of activities related to the traditional villages are very different from those of the tea estates and pine plantations. The scale and gravity of loss of natural vegetation, specifically, the semi-evergreen, montane forest, is heavy where tea has been cultivated at relatively high elevations. Only narrow belts of forest remain along the mountain crest, in some places they are less than 1-2 kilometres wide. These areas may be a priority for restoration and interventions.

The results also identified areas in the interior of KCA (core area) that extend along the river valleys in narrow strips. These manipulated systems represent traditional management of forest resources (e.g., sugar palm stands). Although these areas occur within the core area, they represent important cultural resources and are valuable as illustrations of human innovations that are compatible with conservation. The products and services provided by the forest have facilitated the intrusion, but the terrain and distance from villagers have limited the expansion of the activities. Balancing conservation and development in the traditional villages that have intruded along the valleys, located below the rugged terrain where environmental constraints are lesser, presents a more difficult management problem.

4.6 Capacity building

Capacity building was achieved by provision of MPhil training to three students registered at the local host institution, the University of Peradeniya, specialist course training in GIS to three members of staff at the University of Peradeniya, financing of support for community development in Knuckles, and visits by school-children to experimental sites.

The postgraduate students were jointly supervised by staff from the University of Aberdeen and University of Peradeniya in two cases, and by staff from the Centre for Ecology and Hydrology (subsequently Lincoln University, New Zealand) and the University of Peradeniya in one case. Remote supervision by UK and New Zealand partners was achieved by electronic communication and occasional supervisory visits.

The three students trained to MPhil level are actively seeking employment in the conservation sector in Sri Lanka. One of the RAs, who completed his M.Phil, has applied to join the Sri Lanka Scientific Service with the intention of joining the Forest Department Research Division to take forward his findings on invasion of Caribbean pines and their management by enrichment with native species.

The research sites are regularly used for undergraduate field courses conducted in the Knuckles area and a detailed account of these activities are given in the DI Newsletter No. 04 in June 2009. Support was provided for about 30 school-children from a nearby school to visit the experimental sites to demonstrate the importance of conservation and restoration science.

In addition, two students in the Department of Zoology at UP received training in land molluscs through an earlier Darwin Initiative Project given to Sri Lanka volunteered to establish a bench-mark in land mollusc diversity in abandoned cardamom cultivated areas. As the forest reverts gradually to natural vegetation, this benchmark would be useful to evaluate the changes in composition and diversity.

More than 100 farmers received various type of training through project supported activities and community development committees within at least five villages were strengthened through their involvement in project appraisal, planning, implementation and monitoring. These committees built up experience in defining needs and pursuing partnerships with local service providers with the support of project staff. These skills and the impacts of these successes should be enduring in the villages.

Engagement with this project over the lifespan of the project provided three members of UA staff with professional development opportunities as project partners. Particularly, participating in the mid-term review was a useful exercise for Pinard in monitoring and evaluation and structuring a logframe.

4.7 Sustainability and Legacy

The project has contributed directly to the proposal for recognition of Knuckles as a new World Heritage Site and UNESCO MAB reserve, and to the new management plan that comes into effect in 2010 with World Bank funding to the Forest Department. This was facilitated by the stakeholder workshop in February 2009 that gave rise to a structure for participation of multiple stakeholders in the management planning process. The network initiated during this workshop will develop further with further impetus as a result of formal designation of Knuckles under these international conventions.

The experiments that were established will remain as demonstration sites, and the results of all projects will enhance knowledge on the scientific restoration of degraded sites through publication and dissemination. Ten pamphlets have been prepared on project activities and outcomes in both English and Sinhalese for dissemination among NGOs, private sector stakeholders and school children. The field sites will be maintained and monitored with available funding from other sources and, where feasible, with local forest officers. All field equipment and project vehicles have been donated to the Postgraduate Institute of Science at UP (Appendix 9). As part of the research activities, a bibliography of published material relevant to the Knuckles has been compiled (see project website)

The project partnership will be maintained by joint supervision of a new Aberdeen University PhD student, and new applications for research projects. This will include UK-based private sector tea industry partners that have expressed an interest in the development of organic tea production in their estates around the Knuckles conservation area. One of the Sri Lankan students who studied for a PhD through UA was hired by UP in Sept 09 as a Lecturer; her position in the Department of Botany will facilitate the continuation of the partnership when other members of staff retire in the coming years.

The training provided to communities has enhanced their capacity for income generation through small-scale production of spices and other cash crops.

A Dipterocarp dominated relict forest, a new forest type in the Knuckles region has been located in the Knuckles region during the field work of the DI project which has significantly increased the conservation value of the Knuckles reserve since this forest demarcates the northern-most boundary in Sri Lanka for some of the endemic lowland dipterocarps. A research publication and a pamphlet have been prepared with a message promoting its conservation.

Medawatte, WWWAB, Ekanayake, EMB, Lekamge, CUSB, Fernando SS, Tennakoon, Gunatilleke, CVS, and IAUN Gunatilleke. 2009. A plea for conservation of relict wet forest fragments in the Knuckles Range. Forestry Research Symposium, Kandy, March 2009.

5 Lessons learned, dissemination and communication

The key lessons to be drawn from the experience of this project relate to the process of promoting conservation and development and recognition of the implications of heterogeneity across the Knuckles for management. The project used an approach to community livelihood development that was founded on an approach involving empowerment of existing local committees and facilitating interactions between these committees and local service providers. This approach was effective for mobilizing local capital and expertise for project implementation and for ensuring interventions and development projects were locally relevant. The stakeholder workshop that was held in the final year of the project facilitated consolidation of information and experience from various levels of expertise to contribute to the development of recommendations for future development and land use management decisions in the region.

The buffer zone surrounding KCA is heterogeneous in terms of landscape and culture, human use and forest dependence. Efforts directed at managing this landscape need to be socially and culturally sensitive to ensure that interventions aimed at protecting conservation values do not simultaneously undermine valuable cultural assets. Further, the heterogeneity contributes to the diversity of experience and efforts at community development and conservation that are being implemented in the region. The workshop provided an opportunity to bring together the diversity of experience for a common focus and allowed the group to share and identify lessons learned. These lessons are reflected in the recommendations that were put forward for the management plan. The heterogeneity also means that the threats to environmental protection of the core area vary across the landscape and therefore, it is important that an assessment is completed to prioritize areas needing restoration with appropriate prescriptions, based on their size and position relative to areas of high conservation value and areas of high cultural value.

Information related to project achievements have been disseminated throughout the project lifespan through staff participation in local, regional and national events relevant to the project area, to project partners through newsletters and reports, and to a variety of stakeholders through local meetings, pamphlets, posters, guides and training materials that were developed during the project. The target audience included the main stakeholders for conservation and community development in the buffer zone; these included government (e.g., FD, Provincial Government), conservation groups (e.g., IUCN, Nature Forum), educational institutions (e.g., National Science Foundation, UP, FD Training Institute, local schools), community groups (e.g., development committees, farmers groups). The general public was informed of achievements through local newspaper articles and radio and television broadcast. Dissemination will continue after project completion through the partner institutions and network, through the use of the field sites, pamphlets and training materials. Research findings were disseminated to national scientific audiences throughout the project lifespan through research symposia and national conferences. These will be further disseminated after project completion through publications in peer-reviewed journals.

5.1 Darwin identity

The annual FD Symposium is important for development in Sri Lanka and the project team participated in these symposia each year of the project and had a clear presence. The work undertaken in the project was consistently identified with the Darwin Initiative through inclusion of the logo in presentations, acknowledgement of funding and badging the project as a Darwin project. Through the engagement of project staff and partners in national conservation activities, the project earned recognition for the scientific and applied work conducted through partnerships.

Project team presented themselves as a Darwin group. Multi-stakeholders attended and actively participated in the workshop as a symbol of their recognition, respect and value of the project's contribution to development in Sri Lanka.

The project vehicle carried the logo and field staff had shirts and hats that had the logo and project information on them.

6 Monitoring and evaluation

Throughout the project we used the logframe and milestones as a guide for monitoring our progress. We revised the logframe and milestones annually to increase the detail of activities and indicators to help us evaluate our work. Baseline conditions at the start of the project in relation to the our indicators of achieving the project purpose were not measured explicitly, however, within subsections of the project work, some baseline information was collected that can be used to evaluate longer-term conservation impacts. For example, in the village clusters where the agroforestry innovation research was conducted baseline information on socio-economic conditions and forest dependence was collected and analysed.

Adoption of conservation innovations and their contribution to household incomes could be assessed against this baseline. In the *Pinus* research, an assessment of extent and direction of spread of pine into other habitats was measured and provides a baseline against which future interventions can be measured. In the vegetation analysis that was conducted a baseline of land use types and distribution was established for nine areas in the buffer zone. These baseline assessments do not represent metrics that were used for monitoring project progress towards purpose during the lifespan of the project because the impacts of our work can only be measured for these indicators across a longer time horizon, however, for the FD and Provincial Government, they are useful metrics.

The means of verification that are identified in our logframe (Appendix 2) remain relevant to the project's time frame and in terms of evaluating our progress, we used these as a regular reference point for project meetings, discussions and planning.

Our research quality and productivity was monitored throughout the project through the universities that were responsible for the supervision of the students conducting the research. Their successful completion of chapters, presentations and examinations represents an evaluation of their work.

The project management and finances were monitored at several levels. The project manager was appraised annually and his activities were supervised by the local PI and the UK-based PIs. Project finances were managed locally by the project manager who reported quarterly to the PIs and the overall project finances were monitored and managed by the Finance Section of the University of Aberdeen.

6.1 Actions taken in response to annual report reviews

Yes, these were addressed in our response to the mid-term review in the second Annual Report as explained below. All reviews were discussed thoroughly with partners and collaborators.

We were fortunate to undergo a mid-term review in Dec 2007. This review process provided us with a structure for evaluating our progress and considering how we could better use project resources towards achieving the project purpose. We revised the set of indicators for the project purpose as a consequence. We revised the logframe in both the first and second annual reports to adapt the project to changes in context and perceived need.

The mid-term review recommended greater integration amongst the components of the project and recognized the importance of the team working together effectively. We responded by holding monthly team meetings to exchange information and ideas. We revised project activities and outputs to achieve greater integration across the different rehabilitation models.

The reviewers challenged us to develop more concrete plans for dissemination which we did through newsletters, newspaper articles and radio and television broadcasts. We initiated a quarterly newsletter to facilitate information exchange and to strengthen linkages with other stakeholders. Further, we extended our influence on the management of KFR through interactions with other organizations (e.g., National Science Foundation, the steering committee for the IUCN forest governance project, Nation Building Society).

The reviewers recommended that the project not overlook local expertise when planning activities. Our use of the locally provided GIS and statistics courses is one example of adoption of this recommendation. The reviewers recognized the need for the project activities with communities to "upscale" in order to have a greater impact. We are doing this with the activities planned for two new development sites alongside the PHDT.

7 Finance and administration

7.1 Project expenditure

A change in budget was approved during the first year of the project to shift £10,000 from the conferences, seminars and training budget to field costs. The change reflected a decision to invest in activities in the field, specifically to strengthen the community-based livelihood work, rather than offer a training programme in GIS. The change in priorities was identified by the project team and then supported by the mid-term project review.

Project activities were located at a large number of sites within the Knuckles region, raising costs for transportation from what was originally planned. Also, fuel costs were substantially higher than predicted during the later part of the project period. Therefore, some savings in costs were made under headings office costs, rents, and printing to allow greater spend for field costs and transport. As outlined in the original project budget, we used the other costs category to incorporate field costs, per diems for

volunteers, scholarships for students registered at UP, sample transport, chemical analyses and small equipment.

Table showing original budget by category and year, alongside spend.

	2006/2007	2007/2008	2008/2009	2009/2010	TOTAL
Rents, rates, heating , cleaning, overheads					
• BUDGET					
• SPEND					
Office costs					
• BUDGET					
• SPEND					
Travel and subsistence					
• BUDGET					
• SPEND					
Printing					
• BUDGET					
• SPEND					
Conferences, seminars etc.					
• BUDGET					
• SPEND					
Capital items/equipment					
• BUDGET					
Project vehicle (2/3 4 wheel drive)					
2.5 laptop computers with software					
• SPEND					
Project vehicle (2/3 4 wheel drive)					
2.5 laptop computers with software					
Other costs					
• BUDGET					
• SPEND					
Salaries (from previous table)					
• BUDGET					
Research Assistant UA					
Project Assistants UP					
• SPEND					
Research Assistant UA					
Project Assistants UP					
TOTAL BUDGET					
TOTAL SPEND					

7.2 Additional funds or in-kind contributions secured

Additional funds were secured to sponsor training events in communities related to conservation farming. Cinnamon plants were donated to the community projects from the Export Agricultural Division. UP staff secured funding to support a complementary project on dendrochronology work on pinus, specifically looking at fire scars and fire history. UP staff attended a training workshop on statistics as a consequence of our collaboration with other Darwin projects in south Asia. Additional in-kind contributions were made by both host country and UK partners as additional staff were involved in the project activities and research student supervision.

7.3 Value of DI funding

The research, training and community development that was achieved through the project would not have been possible with DI funding. It covered field costs, transportation costs, and partial staff costs. Furthermore, the funding fostered collaboration both within UP and across various institutions. The dissemination material that was produced and printed for the project would not have been possible without DI funding.

Appendix 1 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements July 2006 – June 2009	Actions required/planned for next period
<p>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</p> <ul style="list-style-type: none"> • 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 <p>Purpose: To enhance the sustainable conservation of biological diversity and ecosystem services in the Knuckles Forest Reserve (KFR), Sri Lanka, by addressing the main threats to environmental protection through the development of options for buffer zone management that improve the livelihoods of local communities.</p>	<ul style="list-style-type: none"> 1. Appropriate restoration and rehabilitation options adopted by Knuckles Communities 2. Communities and local service providers empowered to enhance local livelihoods in a way that reduces dependence on exploitation of forest reserve 3. Capacity developed at UP and among users of rehabilitation options to enhance sustainability of outcomes, including adaptive improvement over time 4. Recommendations for buffer zone management integrated into revisions of management plan for KFR 	<p>(report on any contribution towards positive impact on biodiversity or positive changes in the conditions of human communities associated with biodiversity eg steps towards sustainable use or equitable sharing of costs or benefits)</p> <p>Six communities have directly adopted restoration and rehabilitation practices during the life of the project. More importantly, the development committees within the communities have developed working relationships with a number of local service providers and have learned how to ask for support in an effective way. During the course of the project, staff and students at both the postgraduate and undergraduate levels have developed greater awareness of solutions and capacity to facilitate evaluation and local adaptations of rehabilitation options. Recommendations for the management of the buffer zone were developed jointly with other stakeholders and it seems that some have been integrated into the revision but at this point, the draft document is not in circulation. Unfortunately, the recommendation to</p>	<p>(do not fill not applicable)</p> <p>Although the project is officially finished, the project team continues to provide input to the national and regional efforts to secure the World Heritage Site and MAB nominations, and to work with the Forest Department on the revision of the management plan, with the Provincial Government in the implementation of the recommendations for an operational framework to guide buffer zone development: also, the research sites are being maintained through minimum investment</p>

<p>Output 1. Options for the rehabilitation of degraded areas developed that are relevant to communities in Knuckles</p>	<p>1.1 Research base established and conservation benefits of options documented</p> <p>1.2 Design and dissemination of options supported by network of groups working on conservation and development in the Knuckles area</p> <p>1.3 Incentives exist for the uptake of options (participatory approaches have informed development of options; model sites are in place to motivate and disseminate; market demand for products examined</p>	<p>make the revision process transparent and participatory does not seem to have been taken on board.</p> <p>Research base for restoration of degraded grasslands and cardamom forest established through experimental plots. Implications for conservation documented in pamphlets (English and Sinhala) and disseminated through outreach activities and presentations. Further, conservation and livelihood benefits of a number of conservation farming initiatives established through participatory interventions; documented and disseminated through pamphlets, presentations and outreach activities.</p> <p>Development options were identified by community members and implemented by them, with support from local service provision agencies. Market demand for new crops (e.g., cinnamon) explored through local NGO and private enterprise.</p> <p>Indicators seem appropriate to the output</p>
<p>Activity 1.1 Project Planning Workshop</p>		
<p>Activity 1.2 Conduct research to establish basis for rehabilitation options - Grasslands</p> <p>Yr 1: maintain research sites at Riverston, establish new experiments at three sites;</p> <p>Yr 2: monitor experiments, analyse data, disseminate findings from Riverston;</p> <p>Yr 3: complete thesis, continue to monitor and evaluate research, revise recommendations</p>		
<p>Activity 1.2 – Conduct research to establish basis for rehabilitation options - Pine plantations</p> <p>Yr 1: determine invasiveness and differences in vulnerability to invasion of adjoining habitats;</p> <p>Yr 2: examine interactions between invasiveness and anthropogenic fires;</p> <p>Yr 3: elaborate recommendations regarding invasiveness and disseminate findings, complete thesis and revise recommendations;</p>		
<p>Activity 1.2 – Conduct research to establish basis for rehabilitation options – Cardamom forest</p> <p>Yr 1: Investigate negative impacts of cardamom understories on forest structure</p>		

<p>and composition; identify potential sites for eradication experiment;</p> <p>Yr 2: implement experiment to examine effectiveness of treatments to rehabilitate cardamom forest; disseminate findings from Yr 1 work;</p> <p>Yr 3: stakeholder survey to determine attitudes towards cardamom forest, negative impacts and priorities for eradication</p>	<p>analysis for stakeholder survey underway; this research is part of a doctoral programme that will continue through 2011 at UA. Results disseminated through conference presentations and pamphlets to stakeholders.</p>
<p>Activity 1.1 Conduct research to establish basis for rehabilitation options – Agroforestry innovations</p> <p>Yr 1: document existing agroforestry systems used in 3 traditional villages and gather traditional knowledge and practices related to these systems;</p> <p>Y2: conduct needs analysis for innovations to address local problem;</p> <p>Y3: assess impacts of participatory interventions, complete thesis;</p> <p>Output 2. Improved capacity to implement and adapt options over time</p> <p>2.1 Three MPhil students trained to conduct research and apply results to management problems</p> <p>2.2 At least 3 UP staff trained in GIS</p> <p>2.3 At least 50 representatives from a range of communities and service providing institutions in Knuckles trained in the implementation and monitoring of rehabilitation options</p>	<p>Research completed, thesis drafted and undergoing revision; submission likely end of Sept 2009; Y3 indicator revised as monitoring of interventions was being implemented by partner institution (Export Agriculture); the alternative activity in Y3 by project staff was to examine the conservation implications of the agroforestry innovations in the village clusters.</p> <p>One MPhil student has submitted his thesis and two others have full drafts and expect to submit later in 2009; all three received training throughout the project and have disseminated their findings and recommendations for the buffer zone management plan; in addition, one PhD student from UA has received research and management training, has disseminated results and recommendations;</p> <p>Five project staff trained in GIS, three trained in statistics, two in scientific writing; 30? forestry department and other governmental technical staff trained in pine plantation restoration; more than 150 members of communities were trained in implementation of livelihood development options that promote conservation and livelihood development in the buffer zone.</p> <p>Detailed above</p>
<p>Activity 2.1. Three MPhil students at UP complete programmes (Yr 1, Yr 2, Yr 3) and one PhD student at UA initiates and continues fieldwork (Yr2, Yr3).</p>	
<p>Activity 2.2. At least 5 members of UP project team participate in GIS training (Yr 2)</p>	
<p>Activity 2.3 Project team and partner institutions conduct participatory appraisals and project planning workshops with traditional communities and estate communities (Yr 1, Yr-2)</p>	
<p>Activity 2.4 Project team and partner institutions offer technical training in implementation of rehabilitation interventions (Yr 2, Yr 3)</p>	
<p>Activity 2.5 Project team and partner institutions develop training materials for</p>	
<p>Detailed training materials were developed for grassland restoration, cardamom forest</p>	

dissemination (Yr 3)		restoration, livelihood development, pine invasiveness, kiutul utilisation and agricultural conservation.
<p>Output 3. Communities in Knuckles empowered to articulate their own priorities for livelihood options and to influence decision-making processes in KFR buffer zone</p> <p>3.1 Social capital strengthened in at least 5 communities, with representation from both traditional villages and estates</p> <p>3.2 Innovations being shared within communities (e.g., from farmer to farmer)</p> <p>3.3 Technical capacity of community members enhanced (by participation in training activities listed above, as well as through on the ground support from partner implementing organisations)</p> <p>3.4 Participation of community groups at networking meetings (e.g., Dumbara Surrakino representatives)</p>	<p>As detailed above, farmers groups and community development committees were strengthened through their engagement with and ownership over the process of appraising problems, prioritizing activities, planning activities, implementing activities, and monitoring performance. Evidence across village clusters of farmer to farmer sharing of innovation and information.</p> <p>Farmers groups and representatives from communities with development projects participated in the Stakeholder Consultation Workshop. Undergraduate wildlife foundation of Sri Lanka group are developing activities to promote conservation and to conduct research.</p>	
Activity 3.1 Participatory processes and technical training activities detailed above	Completed.	
Activity 3.2 Develop partnerships with service provision agencies and other buffer zone development groups to share learning and disseminate good practice. (Yr 2, Yr 3)	Completed, beyond expectations. The engagement of a wide representation of agencies and groups	
<p>Output 4. Recommendations for management of buffer zone of KFR</p> <p>4.1 Recommendations articulated and informed by contributions by diversity of stakeholders</p> <p>4.2 Development of timetable for management plan revision</p>	<p>Recommendations have been articulated and disseminated; management plan revision is underway with input from project team. At the close of the project the Forest Department indicated that the period for formal consultation on the revision of the management plan would be held in the later part of 2009.</p>	
Activity 4.2 Workshop held (see 1.3.3.3 above) and recommendations articulated (Yr 3).	Completed	

Appendix 2 Project's final logframe, including criteria and indicators

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>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</p> <p>Purpose To enhance the sustainable conservation of biological diversity and ecosystem services in the Knuckles Forest Reserve (KFR), Sri Lanka, by addressing the main threats to environmental protection through the development of options for buffer zone management that improve the livelihoods of local communities.</p>	<p>1. Appropriate restoration and rehabilitation options adopted by Knuckles Communities</p> <p>2. Communities and local service providers empowered to enhance local livelihoods in a way that reduces dependence on exploitation of forest reserve</p> <p>3. Capacity developed at UP and among users of rehabilitation options to enhance sustainability of outcomes, including adaptive improvement over time</p> <p>4. Recommendations for buffer zone management integrated into revisions of management plan for KFR</p>	<p>Posters, newsletters, published documents</p> <p>Revised management plan</p> <p>World Heritage Status Application</p> <p>Policy Brief outlining response to findings of project</p>	<p>Government policy remains supportive of conservation of KFR;</p> <p>Forest Department remains committed to the adoption of participatory approaches to management of the reserve and buffer zone;</p> <p>Other stakeholders (e.g., private plantation companies, private landowners, other government agencies, NGOs and CBOs) support and implement options for buffer zone management</p>
<p>Outputs</p> <p>1. Options for the rehabilitation of degraded areas developed that are relevant to communities in Knuckles</p> <p>2. Improved capacity to implement and adapt options over time</p> <p>3. Communities in Knuckles empowered to articulate their own priorities for livelihood options and to influence decision-making processes in KFR buffer</p>	<p>1. Research base established and conservation benefits of options documented</p> <p>1.2 Design and dissemination of options supported by network of groups working on conservation and development in the Knuckles area</p> <p>1.3 Incentives exist for the uptake of options (participatory approaches have informed development of options; model sites are in place to motivate and disseminate; market demand for products examined)</p> <p>2.1 Three MPhil students trained to conduct research and apply results to management problems</p> <p>2.2 At least 3 UP staff trained in GIS</p>	<p>1.1 Project reports and publications</p> <p>1.2 Meeting reports, newsletters, and reports by project, project partners and other groups working in Knuckles area</p> <p>2.1 Reports and attendance records of Participatory Appraisals with target groups</p> <p>2.1 Student reports to UP;</p> <p>2.2 Project reports; workshop attendance records;</p>	<p>1.1 External market influences do not provide disincentives to adopt options</p> <p>1.2 Diverse groups working on conservation and development in Knuckles are willing to engage with project partners and participate in activities</p> <p>2. Trained staff remain in institutions and in positions where they can use the skills provided and train others in the skills</p> <p>Information sharing will continue within and between communities. Communities are receptive to adopting new innovations.</p>

<p>zone</p> <p>4. Recommendations for management of buffer zone of KFR</p>	<p>2.3 At least 50 representatives from a range of communities and service providing institutions in Knuckles trained in the implementation and monitoring of rehabilitation options</p> <p>3.1 Social capital strengthened in at least 5 communities, with representation from both traditional villages and estates</p> <p>3.2 Innovations being shared within communities (e.g., from farmer to farmer)</p> <p>3.3 Technical capacity of community members enhanced (by participation in training activities listed above, as well as through on the ground support from partner implementing organisations)</p> <p>3.4 Participation of community groups at networking meetings (e.g., Dumbara Surrakino representatives)</p> <p>4.1 Recommendations articulated and informed by contributions by diversity of stakeholders</p> <p>4.2 Development of timetable for management plan revision</p>	<p>2.3.1 Training and monitoring workshop records:</p> <p>2.3.1.1 Training and monitoring methods materials produced</p> <p>3.1.1 Community organisations emerged or strengthened, documented by membership lists and registration with Department of Environment</p> <p>3.1.2 Community groups participating in innovations, training and PRAs (project reports)</p> <p>3.2 Project reports</p> <p>3.3 Reports from partner institutions and service provision organisations</p> <p>4. Documented correspondence with Forest Department</p>	<p>4. Management plan remains open for revision.</p>
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<p>Activities</p> <p>Rehabilitation Options</p>	<p>Project planning workshop (Yr 1: Stakeholder workshop with project team to agree workplan, define tasks and priorities)</p> <p>Conduct research to establish basis for rehabilitation options</p> <p>Degraded grasslands (Yr 1: maintain research sites at Riverston, establish new experiments at three sites; Yr 2: monitor experiments, analyse data, disseminate findings from Riverston; Yr 3: complete thesis, continue to monitor and evaluate research, revise recommendations)</p> <p>Pine plantations (Yr 1: determine invasiveness and differences in vulnerability to invasion of adjoining habitats; Yr 2: examine interactions between invasiveness and anthropogenic fires; Y2: elaborate recommendations regarding invasiveness and disseminate findings, complete thesis and revise recommendations;</p> <p>Cardamom forest (Yr 1: investigate negative impacts of cardamom understories on forest structure and composition; identify potential sites for eradication experiment; Yr 2: implement experiment to examine effectiveness of treatments to rehabilitate cardamom forest, disseminate findings from Yr 1 work; Yr 3: stakeholder survey to determine attitudes towards cardamom forest, negative impacts and priorities for eradication)</p> <p>Agroforestry innovations (Yr 1: document existing agroforestry systems used in 3 traditional villages and gather traditional knowledge and practices related to these systems; Y2: conduct needs analysis for innovations to address local problem; Y3: assess impacts of participatory interventions, complete thesis;</p> <p>Design and disseminate options</p> <p>Implement demonstration plots for options and interventions (Yr 2: riparian development, homegarden development, highland; Y3: pinus conversion, shrubland conversion)</p> <p>Develop dissemination material for various options and interventions (Y2: pine conversion, pine invasion, grassland restoration; Yr3: homegarden development, highland development, riparian development).</p> <p>Buffer zone development workshop (Yr 3: workshop for sharing learning and best practice amongst groups working in Knuckles)</p> <p>Develop partnerships with plantation owners, FD and others to identify opportunities for implementation of trials for pine conversion, restoration of degraded grasslands, or other innovations aimed at enhancing conservation value of land within the buffer zone and/or reducing dependency on exploitation of forest reserve.</p>	<p>Capacity Building</p> <p>Three MPhil students at UP complete programmes (Yr 1, Yr 2, Yr 3) and one PhD student at UA initiates and continues fieldwork (Yr2, Yr3).</p> <p>At least 5 members of UP project team participate in GIS training (Yr 2)</p> <p>Project team and partner institutions conduct participatory appraisals and project planning workshops with traditional communities and estate communities (Yr 1, Yr 2)</p> <p>Project team and partner institutions offer technical training in implementation of rehabilitation interventions (Yr 2, Yr 3)</p> <p>Project team and partner institutions develop training materials for dissemination (Yr 3)</p>	<p>Empowered Communities</p> <p>Participatory processes and technical training activities detailed above</p> <p>Develop partnerships with service provision agencies and other buffer zone development groups to share learning and disseminate good practice. (Yr 2, Yr 3)</p> <p>Recommendations for management of buffer zone of KFR</p> <p>Profiles of organizations and projects working on sustainable management in the buffer zone prepared and compiled (Yr 3)</p> <p>Workshop held (see 1.3.3.3 above) and recommendations articulated (Yr 3).</p> <p>Discussion meeting with policy-makers to review recommendations and identify ways forward (Yr 4).</p>
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Appendix 3 Project contribution to Articles under the CBD

Project Contribution to Articles under the Convention on Biological Diversity

Article No./Title	Project %	Article Description
6. General Measures for Conservation & Sustainable Use		Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring		Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
8. In-situ Conservation	50	Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
9. Ex-situ Conservation		Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity		Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures		Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	30	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
13. Public Education and Awareness		Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
14. Impact Assessment and Minimizing Adverse Impacts		Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
15. Access to Genetic		Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound

Article No./Title	Project %	Article Description
Resources		uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.
16. Access to and Transfer of Technology		Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
17. Exchange of Information		Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol		Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Other Contribution	20	Smaller contributions (eg of 5%) or less should be summed and included here.
Total %	100%	Check % = total 100

Appendix 4 _ Standard Measures

Code	Description	Totals (plus additional detail as required)
Training Measures		
1a	Number of people to submit PhD thesis	1 (Nepalese through UA)
2	Number of Masters qualifications obtained	3 (MPhil degrees for Sri Lankans through UP)
4a	Number of undergraduate students receiving training	Approx 80
4b	Number of training weeks provided to undergraduate students	Approx one week
4c	Number of postgraduate students receiving training (not 1-3 above)	4 (MPhil and PhD students working alongside project staff)
4d	Number of training weeks for postgraduate students	2 (ATBC workshops for postgrads)
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification(ie not categories 1-4 above)	4 (field assistants, trained in data collection, data entry, herbarium techniques)
6a	Number of people receiving other forms of short-term education/training (ie not categories 1-5 above)	5 (GIS training for Sri Lankan and Nepalese project team members) Approx 150 (members of communities, short courses related to conservation farming techniques, organic farming, cinnamon cultivation) Approx 30 Forest Department staff in pine plantation conversion
6b	Number of training weeks not leading to formal qualification	Approx 8 weeks
7	Number of types of training materials produced for use by host country(s)	2 (booklet on pine plantation conversion, roadside guide to ecology in the Knuckles Forest Reserve); 6 pamphlets (each in English and Sinhala) (spread of <i>Pinus</i> , cardamom forest restoration, alternative livelihood development initiatives, alternative pathways for sustainable livelihoods, Kitul gold mine, restoration of degraded grasslands, restoration and development in buffer zone)
Research Measures		

Code	Description	Totals (plus additional detail as required)
8	Number of weeks spent by UK project staff on project work in host country(s)	36
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	1 (document w/ recommendations for management plan)
10	Number of formal documents produced to assist work related to species identification, classification and recording.	2 (invasive species identification booklet and poster, floristic inventory of forest fragment of high conservation value outside the protected area)
11a	Number of papers published or accepted for publication in peer reviewed journals	0
11b	Number of papers published or accepted for publication elsewhere	0
13a	Number of species reference collections established and handed over to host country(s)	1 (seed and seedling database)
13b	Number of species reference collections enhanced and handed over to host country(s)	
Dissemination Measures		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	1 (pine conversion)
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	23 (one FD conf x 3y x 3 students, one UP conf x 3y x 4 staff, one ATBC x 2 students, one invasive spp)
15a	Number of national press releases or publicity articles in host country(s)	0
15b	Number of local press releases or publicity articles in host country(s)	2 (Pine invasiveness)
15c	Number of national press releases or publicity articles in UK	0
15d	Number of local press releases or publicity articles in UK	0
16a	Number of issues of newsletters produced in the host country(s)	8
16b	Estimated circulation of each newsletter in the host country(s)	30
16c	Estimated circulation of each newsletter in the UK	5
17a	Number of dissemination networks established	1 (from stakeholder workshop)

Code	Description	Totals (plus additional detail as required)
17b	Number of dissemination networks enhanced or extended	0
18a	Number of national TV programmes/features in host country(s)	0
18b	Number of national TV programme/features in the UK	0
18c	Number of local TV programme/features in host country	1 (pine invasiveness)
18d	Number of local TV programme features in the UK	0
19a	Number of national radio interviews/features in host country(s)	0
19b	Number of national radio interviews/features in the UK	0
19c	Number of local radio interviews/features in host country (s)	2 (pine invasiveness, livelihoods and community development)
19d	Number of local radio interviews/features in the UK	0
Physical Measures		
20	Estimated value (£s) of physical assets handed over to host country(s)	Vehicle – £10,000 Motorbike - £500 Computers, printers, UPS, external hard drives - £200
22	Number of permanent field plots established	20
23	Value of additional resources raised for project	Approx £15,000 (donations of plants, training and monitoring support in community projects, improved stoves, postgraduate training and travel to ATBC conference)

Appendix 5 Publications

Type *	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
<i>Journal of Applied Ecology</i>	Gunaratne, AMTA, Gunatilleke, CVS, Gunatilleke, IAUN, Madawala Weerasinghe, HMSP and Burslem, DFRP Barriers to tree seedling emergence on human-induced grasslands in Sri Lanka., XX, XX.	Blackwell Publishing Co.	<i>Journal of Applied Ecology (in press)</i>	N/A

Appendix 6 Darwin Contacts

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