Darwin Initiative

Annual Report

1. Darwin Project Information

Project Ref. Number	*162/13/033*
Project Title	*Combating alien invasive plants threatening the East Usambara mountains in Tanzania*
Country(ies)	*Tanzania*
UK Contractor	*Centre for Ecology & Hydrology & Tropical Biology Association*
Partner Organisation(s)	*Amani Nature Reserve & Sokoine University of Agriculture*
Darwin Grant Value	*£153,120*
Start/End dates	*01/04/05 to 31/03/08*
Reporting period (1 Apr 200x to 31 Mar 200y) and annual report number (1,2)	*01/04/05 to 31/03/06 Annual Report 1*
Project website	http://www.ceh.ac.uk/sections/ed/Usambara_project_page.html
Author(s), date	*Philip Hulme & Rosie Trevelyan*

2. Project Background

The East Usambara Mountains are one of the most important areas within the Eastern Arc Mountain Forests of Tanzania, a global biodiveristy hotspot internationally recognised as a conservation priority due to the exceptional concentrations of endemic species. While the pressures from deforestation have receded following the establishment of the Amani Nature Reserve in 1997, biodiversity continues to be endangered by the rapid spread of invasive alien plants (IAP). Many of the tropic's most pernicious IAP including herbs (e.g. Clidemia hirta), shrubs (e.g. Lantana camara), palms (e.g. Elaeis guineensis) and trees (e.g. Psidium cattleianum), have been introduced to the Amani Botanic Garden over the last century. Subsequently, many have spread widely in the East Usambaras where they have replaced native species and altered ecosystem processes. At present the extent of the invasions and their environmental consequences remain unquantified but experience from other tropical forest ecosystems indicates the potential for substantial impacts. The dynamic nature of these invasions implies that action must be undertaken now if cost effective management strategies are to stand any hope of safeguarding biodiversity.

3. Project Purpose and Outputs

The East Usambara forests have been likened to the African equivalent of the Galapagos Islands in terms of their endemism and biodiversity and are

considered to be one of the most important forest areas in Africa. As a signatory of the Biodiversity Convention, Tanzania has a commitment "to strictly control the introduction of non-indigenous species". It is with this background that the project had the following aims:

1. ***To assist Tanzania, a nation rich in biodiversity but poor in resources with the conservation of biodiversity in the East Usambaras and in the implementation of Articles 5-6, 8h (alien species), 12-14, & 16-17 of the Biodiversity Convention.***
2. ***To draw on leading British expertise in the field of monitoring, assessment and management of plant invasion impacts on biodiversity to ensure scientific excellence, high quality research outputs and long-term collaborative partnerships.***
3. ***To collaborate with local government, NGO and academic institutions via information dissemination, capacity building and infrastructural support in order to establish a legacy of trained expertise and sustainable strategies for IAP management.***
4. ***To provide a benchmark for best practice in the management of plant invasions in East Africa and establish a strong platform for levering additional funding to continue and expand the project e.g. Earthwatch, Leverhulme, NERC, EU***

The key outputs of the project will be to: a) raise awareness among leaders & increasing inter-sectorial cooperation, b) develop capacity to identify IAP and production of identification manuals, c) establish monitoring programmes, and d) develop management strategies. The project will be pivotal in resolving these key obstacles to IAP management in Tanzania, comply with actions agreed at COP & help conserve global biodiversity.

The project has largely proceeded to plan, there are only two exceptions: The first is the delivery of the workshop on "Mapping and Monitoring Invasive Plants" which has been postponed from summer 2005 to summer 2006. It was felt the workshop would be more effective with additional information gathered from the first year of the Darwin project and in addition, the procedures for organising, planning and inviting participants to the workshop required a longer lead-time. The second is that we now are employing <u>two</u> Darwin Scholars but the Sokoine University of agriculture MSc course structure means they will not begin fieldwork until summer 2006. Thus fieldwork to date has largely depended on inputs from the UK partners.

4. Progress

The primary aims for the first year were to formalise links will collaborating institutions; collate historical details of alien plantations, existing vegetation survey data and the EUCAMP GIS database; establish monitoring and mapping programme; run training course in invasion ecology, database design and GIS to Tanzanian staff in Amani; produce identification guides and website. In summary, the main goals were achieved (as described in detail below and in Annex 1). The project was kick started by UK partners visiting Tanzania and establishing links with local partners: Government, NGOs and Universities. Data availability was assessed and where possible relevant datasets collated. The GIS appeared to be rather limited and what digital map information available was of limited use. Two Darwin Scholars and one UK PhD student were interviewed and appointed subsequently beginning their studies in the project. The training course has been shifted to Year 2 so as to make better use of project datasets and ensure appropriate participation as well as facilities.

Considerable effort has been made to formalise links and increase awareness in partner institutions over the last year. <u>Key meetings</u> were held with the Ministry of Natural Resources and Tourism, Forest and Beekeeping Division

(NRTFBD), the Tanzanian Forest Research Institute (TAFORI), Dar es Salaam University (Institute of Resource Assessment) and Sokoine University of Agriculture (SUA), Morogoro (Faculty of Nature Conservation). Subsequently, Memoranda of Understanding were signed with both between the project and both NRTFBD & SUA cover the research and training elements of the Darwin project. Important NGOs were approached including the Eastern Arc Mountain Conservation and Management Project, Eastern Arc Mountain Conservation Endowment Fund and the Critical Ecosystem Protection Fund). Formal links were established with the Amani Nature Reserve and approval was agreed for research to be undertaken by the PhD and MSc students in Amani. Throughout biological invasions were seen as a major knowledge gap in conservation activities and considerable information exchange took place to the benefit of all parties.

With respect to <u>training</u>, the advertising and interviewing of candidates for the Darwin Scholar MSc positions at Sokoine University generated considerable interest (>30 applications) and a strong shortlist drawn up for interview in Morogoro. The two successful candidates were Mr John Richard and Mr Ezekiel Edward. As well as being high calibre and enthusiastic students, they provide strong links to partner institutions TAFORI and SUA. The TBA ran a weeklong course on proposal writing in Morogoro in August. Further contribution to the training component of the project was made by NERC in supporting a three-year PhD student, Mr Wayne Dawson, whose thesis will be closely allied to the aims of the Darwin project. His thesis is entitled "What determines species invasiveness? Testing traits with tropical trees" and field studies will: a) generate an updated inventory of plantations recording detailed data on performance and life-history; b) quantify dispersal success by estimating the spatial distribution and approximate age of recruits in neighbouring forest; c) characterise invaded habitats e.g. montane/lowland, gap/edge etc. to determine how habitat acts as a filter on species traits. A further NERC PhD student, Ms Samantha Irish, has also been appointed to the project and will begin her studies in October 2006. Her thesis is entitled "Dispersal mode; colonisation and species coexistence in tropical forests: a test using historical non-native plant introductions" and will integrate knowledge of the location, size and date of introductions with habitat associations to provide a basis for the first community wide comparative analyses of "dispersal niches". Complimentary studies on a subset of focal species will quantify the mechanisms underlying these patterns including the importance of escape from herbivores, seed/microsite limited recruitment and the quantity/quality component of dispersal. Data will be used to model the consequences of forest fragmentation, corridor creation and disturbance on invasion. These two PhD studentships have led to closer involvement from the University of Aberdeen in the Darwin project. Mr Dawson participated in the month long TBA Tropical Ecology field course in Amani, East Usambara Mts during September in which both the UK partners participated. The course had a major emphasis on biological invasions and training was given to an additional three Tanzanian students as well as 20 international students. The workshop on "Mapping and Monitoring Invasive Plants" is now being advertised in Tanzania including a call for applicants (see Appendix)

The first step in the <u>assessment and monitoring</u> of biological invasions relates to data collation on non-native plants in the East Usambaras. Data have now been gathered on the original non-native plantations as well as subsequent surveys. These data have been enhanced by additional field surveys that have identified the levels of regeneration occurring within the plantations and have enabled a list of key problem species to be identified. These will form the basis of fact sheets that will be produced in 2006 (rather than 2005). Data have been entered into Excel and represent a sizeable database for which preliminary analyses have already been made. The primary finding to date highlight that

survival of the plantations is strongly influenced by human settlement nearby and that the disappearance of species may not only reflect the biology but also the proximity to human land use. Factoring in this aspect will be essential when attempting to undertake comparative analyses of species success. Preliminary results indicate that that neither the number of plantations or the date of introduction significantly influences invasion success but that biogeographic origin (especially neotropical species) and life-form (especially lianas and palms) being important. Data from previous vegetation surveys were collated but the intensity of these surveys is unlikely to be of value for mapping invasive species. Difficulties have been encountered in tracking down the East Usambara GIS, what information has been gathered amounts to little more than a digital map. There are concurrent activities being undertaken at Dar es Salaam University that may generate a GIS before the end of project deadline.

Table 1. Timetable (workplan) for the next reporting period (2006-07)

Activities	*A*	*M*	*J*	*J*	*A*	*S*	*O*	*N*	*D*	*J*	*F*	*M*
UK Experts visit Tanzania			*	*							*	
Mapping workshop			*									
Mapping non-native species	*	*	*	*	*	*						
Assessment invasive success	*	*	*	*	*	*						
Oral paper at BES Annual Meeting						*						
Darwin Scholars study priority spp.				*	*	*	*					
Production non-native fact sheets							*	*				
Comparative analysis of spp. traits							*	*	*			
Integration of spatial data in GIS								*	*	*		
Planning of dispersal studies									*	*	*	
Dispersal studies initiated											*	*
Darwin Reporting	*					*						*

Important developments in the project in the first year include the reticence of the Amani Nature Reserve to support any management of invasive species using chemicals. It was made clear that such activity would not be acceptable due to the status of the East Usambaras as catchment forests. Although biodegradable herbicides would have limited long-terms impact on water quality or biodiversity, the UK partners will respect this decision. However, this puts a constraint upon management options. While a management plan for the nature reserve exists, the project will focus on detailing options for managing invasive species and the possible tools available (and if possible cost) of any actions.

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

Not applicable, first annual report.

6. Partnerships

Partnerships have been initiated with considerable success and it appears collaborations are moving forward smoothly without undue problems:

Mr. Isaya Y. Mnangwone, Assistant Director Research, Training and Statistics (Ministry of Natural Resources and Tourism, Forest and Beekeeping Division) was especially enthusiastic about the project and a Memorandum of Understanding (MOU) was subsequently drawn up relating to the training and

research provision inherent in the Darwin Project. Mr L Nsubemeki, the Director General of the Tanzanian Forest Research Institute (TAFORI) approved the project and emphasised the increasing need for capacity building in the area of biological invasions. Formal links were established with the Amani Nature Reserve through the Head Conservator, Mr Corodius Sawe, and approval was agreed for research to be undertaken by the PhD and MSc students in Amani. These steps have been essential in obtaining the relevant research permits from the Tanzania Commission for Science and Technology. Formal meetings were arranged at Sokoine University of Agriculture (SUA), Morogoro (Faculty of Nature Conservation). A round table meeting to discuss the project was held with the Heads of several departments. Subsequently an MOU was signed between the University and the TBA that covers the research and training elements of the Darwin project. The third group of stakeholders approached were the NGOs including the Eastern Arc Mountain Conservation and Management Project (Dr Neil Burgess) and Eastern Arc Mountain Conservation Endowment Fund (Mr Shedrack Mashauri) as well as with the Critical Ecosystem Protection Fund (Dr John Watkins). Dr Neil Burgess was especially helpful in supplying reports and data to aid the progress of the project. It is hoped to closely link the work of the Darwin project to both the Eastern Arc Mountain Conservation and Management Project and Critical Ecosystem Protection Fund.

7. Impact and Sustainability

It is early days in the life of the project for it to have made major impact, however through personal contacts, in-country meetings, the website as well as the call for Darwin Scholarships and the Mapping Workshop there is increasing awareness of the project in Tanzania. The original exit strategy was evidence of control or eradication of at least one invasive species. The constraints imposed by the nature reserve of not using chemical methods in any management suggest that this can no longer be an appropriate exit strategy. Rather, we will provide a priority listing of target species, evidence of their impacts on biodiversity and suggested management approaches (both chemical and physical).

8. Outputs, Outcomes and Dissemination

A summary of the proposed and actual outputs agreed in the initial 'Project Implementation Timetable' and the 'Project Outputs Schedule' highlight where progress has been made (Table 2, 3). A certain amount of slippage has arisen due to the change in date of the workshop with consequences for the preparation of materials and training of staff. Furthermore, priorities have changed to focus on the spatial data collation rather than preparation of a GIS since Dar es Salaam University may produce the latter within the next year. With respect to dissemination, more substantial press releases can be generated after the preliminary data collation in order to highlight not only the scope of the work but also preliminary findings. The project has been disseminated to TAFORI journalists but a proposed seminar at Sokoine University was postponed due to difficulties at the University. In the future (and beyond the project) it is envisaged that the work will continue to be disseminated through peer reviewed papers (for the scientific audience) and articles targeting the general public e.g. NERC Planet Earth. However, the TBA will also contribute t o further dissemination (to students) through the course held at Amani, using the project work as case studies and the basis for lecture and practical material.

Table 2. Proposed and actual outputs agreed in the Proposal

Output	Proposed Date	Actual Date	Comment
Kick start meetings with Universities, TAFORI & ANR	*Apr. 2005*	*Apr. 2005*	*-*
Three week visit to Tanzania by 2 UK project staff	*Apr. 2005*	*Apr. 2005*	*-*
Website established	*Jun. 2005*	*Jun. 2005*	*-*
International press release through IUCN Aliens Newsletter	*Jul. 2005*	*-*	*Press release planned for 2006 in order to present more substantial information on work to date*
UK Press release through NERC Press Office	*Jul. 2005*	*-*	*Press release planned for 2006 in order to present more substantial information on work to date*
GIS of East Usambara Forest Reserves developed	*Jul. 2005*	*-*	*Appropriate data not available and similar work proposed at Dar es Salaam University*
Training material for "GIS in Biological Invasions" course prepared & published on web	*Aug. 2005*	*-*	*Course postponed to June 2006*
Poster describing project presented at British Ecological Society Annual Meeting	*Sept. 2005*	*-*	*Replaced by oral paper in 2006*
Tropical Biology Association field course in Amani (1 month): Two Tanzanians trained	*Sept. 2005*	*Sept. 2005*	*-*
Three week visit to Tanzania by 2 UK project staff	*Oct. 2005*	*Sept. 2005*	*-*
Amani Nature Reserve Management Board Meeting: UK specialist staff participate	*Oct. 2005*	*Oct. 2005*	*-*
"Mapping & Monitoring Biological Invasions" course run in Amani (10 days): Ten Tanzanians trained	*Oct. 2005*	*-*	*Course postponed to June 2006*
Two MSc Research Projects start in Tanzania	*Nov. 2005*	*-*	*Students started training in Sept. 2005 but research project will begin in June 2006*
PhD student begins research	*-*	*Oct 2005*	*New output*

Table 3. Project Outputs (According to Standard Output Measures)

Code No.	Description	Year 1 Total	Year 2 Total	Year 3 Total	Year 4 Total	TOTAL
8	*Three week visit to Tanzania by 2 UK project staff*	3				
7	*Website providing guidance on problems of invasive plants*	1				
4C	*Three Tanzanians trained on TBA Tropical Ecology course*	3				
4D	*Four weeks training for two Tanzanians on TBA course*	4				
6A	*Two Tanzanians initiate MSc studies*	2				
6B	*Six months training to two MSc students*	2				
8	*Three week visit to Tanzania by 2 UK project staff*	3				

No publications were produced in the first year of the project

Table 4. Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (e.g. contact address, website)	Cost £

9. Project Expenditure

Table 3: Project expenditure during the reporting period (Defra Financial Year 01 April to 31 March)

Item	Budget (from revised budget schedule Feb 2006)	Expenditure	Balance

10. Monitoring, Evaluation and Lessons

The project has a fairly clear set of targets based on quantitative research, training and dissemination. The process rests on feedback and regular reporting from staff involved in the project. Having a UK based operative (PhD student) based in Tanzania for much of the year allows a rapid route for information flow and progress assessment. Although not involved in the running of the project, having someone at the field site allows contact to be maintained more effectively with partners than through email alone. At this stage of the project much time has been invested in establishing the key components of the project, MSc students, site permission, data gathering etc. and the success can be judged by the fact that these have all been achieved. Important lessons have been learnt in the first year. It is easy to be over ambitious in the proposal and the reality can often be quite different in the field. This has been the case with workshop organisation that has taken more time to prepare. Although not budgeted for in the proposal, the additional resource levered from NERC to support a PhD student has proved crucial in paving the way for the project. Having a key staff member in place early in the project certainly facilitates the logistics.

11. OPTIONAL: Outstanding achievements of your project during the reporting period (300-400 words maximum)

Early days for presentation of outstanding achievements

Annex 1 Report of progress and achievements against Logical Framework for Financial Year: 2005/2006

Project summary	Measurable Indicators	Progress and Achievements April 2005-Mar 2006	Actions required/planned for next period
Goal*:* To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve • The conservation of biological diversity, • The sustainable use of its components, and • The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources			
Purpose To empower researchers in the Tanzanian Forestry Research Institute, East Usambara Conservation & Management Program and Sokoine & Dar Es Salaam Universities to map, monitor & manage invasive alien plants in the Eastern Arc Mountains so as to safeguard globally important biodiversity and satisfy Tanzania's CBD obligations)	Distribution maps of IAP species abundance in the main forest areas of the East Usambaras used to direct IAP control programme. Invasion models for priority problem species developed. Evidence of invasive plant species eradication and/or control.	*Spatial data collated for the distribution of regenerating IAP in the plantations* *Data gathered identifying priority species* *No progress expected in year 1*	*Extend survey to surrounding forest blocks* *Collect demographic data* *Lack of support for chemical control efforts in Amani indicate that indicator will have to relate to potential methods not actual control*
Outputs			
Four partner institutions able to monitor and manage the long term eradication of IAP in the East Usambaras	A minimum of 10 staff from 4 partner institutions trained in invasion ecology and IAP management	*Workshop postponed to 2006 to ensure adequate information, facilities and participants*	*Workshop planned for mid-June 2006*
IAP identification guides produced	Guidelines published, 100+ copies produced/distributed as hardcopies and on web	*Guidelines had to await identification of priority species*	*Will be produced in 2006*

IAP Management strategy in place	Strategy developed in collaboration with UK and Tanzanian staff	*No progress expected in year 1*	*Review current nature reserve management plan & diplomatically identify opportunity to include section on invasive species*
Publications	2+ newspaper articles, 4+ journal papers, workshop proceedings published	*No progress expected in year 1 but one interview with Forestry Department Press office*	*Scientific publication expected in Year 3, BES oral presentation in Year 2. Need to plan for press releases and identify appropriate routing.*

Note: Please do NOT expand rows to include activities since their completion and outcomes should be reported under the column on progress and achievements at output and purpose levels.

ANNEX 2 ORIGINAL PROJECT LOGICAL FRAMEWORK

Project summary	Measurable indicators	Means of verification	Important assumptions
Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve • the conservation of biological diversity, • the sustainable use of its components, and • the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources			
Purpose To empower researchers in the Tanzanian Forestry Research Institute, East Usambara Conservation & Management Program and Sokoine & Dar Es Salaam Universities to map, monitor & manage invasive alien plants in the Eastern Arc Mountains so as to safeguard globally important biodiversity and satisfy Tanzania's CBD obligations	Distribution maps of IAP species abundance in the main forest areas of the East Usambaras used to direct IAP control programme. Invasion models for priority problem species developed. Evidence of invasive plant species eradication and/or control.l	IAP identification guides in use Invasion models for priority problem species tested. Management strategies put in practice in the field Results published in peer reviewed journals and on website	Researchers integrate new knowledge into future management of IAP in East Usambara forests Project resource at least match scale of IAP problem in order to assess scope for control. Partners attract additional support to continue control strategies following project completion.
Outputs Four partner institutions able to monitor and manage the long term eradication of IAP in the East Usambaras	A minimum of 10 staff from 4 partner institutions trained in invasion ecology and IAP management	IAP distribution database Participant attendance and assessment records	A high % of participants complete training, pass assessments and continue present employment.
IAP identification guides produced	Guidelines published, 100+ copies produced/distributed as hardcopies and on web	2 copies sent to Darwin Initiative	Publisher and distribution method identified
IAP management strategy in place	Strategy developed in collaboration with UK and Tanzanian staff	IAP management strategy endorsed by local NGOs and published	Cooperation among partner organisations & availability of resources
Publications	2+ newspaper articles, 4+ journal papers, workshop proceedings published	Copies of all publications sent to Darwin Initiative	Sufficient media interest & quality of research outputs
Activities	**Activity Milestones (Summary of Project Implementation Timetable)**		
Workshops	Yrs1-3: Annual project workshops (1wk July); Yr1: Start-up workshop with project team to establish priorities, methodologies and procedures for data collation and to develop the tailor-made training programmes (1wk Aug 05); Invasion ecology training workshop (2 wks Oct 03); Yr 2: Statistics workshop (1wk Aug 06); Yr 3: Invasive Species in East Africa workshop (1wk Mar 08) proceedings of which produced 6wks afterwards		
Field Research Programme	Collate details of IAP plantation, existing vegetation survey data and EUCAMP GIS database (Sept 05); Protocols for field surveys and target species produced and agreed (Oct 05). Field surveys completed (Aug 04); Impact studies completed (July 05); Control studies completed (Mar 08)		
Manual Development	Collation of information on surveys, impact studies and control trials. Draft management manual produced (Dec 07). Publication (Mar 08)		
Publicity Material	Newspaper and radio coverage (yrs 1-3), project information in local NGO publications (various dates), IAP identification guides published (yr 2); 2 scientific publications drafted (in each of yrs 2& 3), workshop proceedings published (May 08)		