Darwin Initiative

Annual Report

1. Darwin Project Information

Project Ref. Number	13/001
Project Title	Conservation of wetlands and associated Biodiversity in Northern Zambia
Country(ies)	UK and Zambia
UK Contractor	University of Aberdeen
Partner Organisation(s)	Kasanka Trust, Zambia (KTL)
Darwin Grant Value	£131,669
Start/End dates	1 April 2004 to 31 March 2008. (Revised end date)
Reporting period (1 Apr 200x to 31 Mar 200y) and annual report number (1,2,3..)	1 April 2005 – 31 March 2006. Annual Report No.2
Project website	www.Kasanka.com
Author(s), date	Professor Paul Racey with input from Professor Chris Soulsby, Dr. Glenn Iason, Dr. Mike Kennedy, Edmund Farmer & Martin Stanley. April 2006

2. Project Background

- Briefly describe the location and circumstances of the project and the problem that the project aims to address.

The project is taking place in Kasanka National Park (KNP) in Northern Zambia, one of two independently run parks in Zambia. The conservation concern is that despite seasonal inundation of grasslands during the rains, and rivers that never dry, some of the distinctive habitats in the park, the papyrus swamp and the mushitu evergreen swamp forest, may be drying out and their distinctive biodiversity threatened (sitatunga (*Tragelaphus spekeii*) and straw coloured fruit bats (*Eidolon helvum*) respectively). The established management practice of seasonal burning may also interact with these hydrological considerations and influence habitat dynamics and sustainability. Now that internationally competitive tourist accommodation is available there is also a need to enhance the capacity of the park to attract tourists by training environmental educators and guides, and to make the fullest use of the distinctive niche occupied by KNP.

3. Project Purpose and Outputs

Purpose

• To secure the future of Kasanka's distinctive biodiversity through the conservation of sensitive habitats, particularly wetlands.

• To train local people to build their capacity for environmental education of community members and visitors to the area.

• To enhance the capacity of KNP to attract tourists and thereby achieve financial self sustainability.

• To provide baseline data on the natural resources of the KGMA, facilitating the development of plans for sustainable resource utilisation.

• To alleviate poverty through improved conservation and sustainable utilisation of natural resources and enhanced employment and the facilitation of rural development projects.

Outputs

Year/Month Starting April	Standard Output Number (see standard output list)	Description (include numbers of people involved, publications produced, days/weeks etc)
04/09-05/09 05/09-06/09	2	Two Zambian graduates to year long MSc course in Tourism And conservation at DICE.
04/09-05/09 05/09-06/09 06/09-07/09	5	Three Zambians each year trained as conservation and ecology educators and guides
05/06-05/09 06/06-06/09	4A/C	Aberdeen University biological expeditions consisting of 4 AU students partnered with 4 Zambian students separately funded by AU, Carnegie Trust, BES and BP Conservation Programme.
05/06-05/09 06/06-06/09	4B/D	10 weeks in each of two years
04 & 05	7	A video already commissioned from a professional film maker (and funded separately by Holly Hill Trust) to include publicity for Darwin Project. Posters on Communal Wildlife Management and on Communal Forestry Management. A manual on Hydrological and Fire Management will be produced (and installed on the website)
04/09-05/03 05/04-06/03	8	78 weeks: postdoctoral hydrologist at KNP.
06/03 06/04-07/04 07/04-08/07	8	78 weeks: postdoctoral ecologist at KNP.
04/05/06/07	8	A total of 4 weeks per annum by two AU professors and Principal Scientist from Macaulay Land Use Research Institute
07	9	A hydrological and fire management Plan
07	9	GMA resource map
07	11B	4 papers to be submitted
04/05/06/07	14A	Annual Workshops held for Stakeholders and at beginning and end of project (n=4).
05/06/07 04/05/06/07 05/06/07	14B 15A, 15B 15C 16A, 16B	 One Conference per annum attended by postdocs. One of each press release in each calendar year. Two electronic newsletters per annum to 200 recipients
05/06/07	18A	One TV programme per annum.
04/05/06/07	19A 19B 19C	One in each calendar year of project One for BBC World Service One in each calendar year of project
07	20	3 year old Landrover Defender value £5K 2 Laptop computers £400; GPS handsets £100; Reprint collection and similar resource materials
04-07	23	£120K: £25Kpa from Holly Hill Trust £15Kpa value of time donated by Principals and others

Modifications to outputs and proposed operational plan:

The original proposal aimed to appoint a postdoctoral hydrologist for the first 18 months of the project followed by a postdoctoral grazing ecologist for the second 18 months. However, shortly before the (delayed) announcement of the results of the round 12 competition, the post doctoral hydrologist named on the application accepted a post with The Scottish Environment Protection Agency. Rather than seek a replacement immediately, the project leader decided to wait until two other members of the project team, Chris Soulsby, a hydrologist and Glenn Iason, a grazing ecologist from the Macaulay Land Use Research Institute (MLURI) had visited KNP to devise a workplan for the hydrological and ecological investigations required and assess the skills required. They concluded that greater continuity in the research aspects of the project would be achieved by appointing a postdoctoral hydrologist with an interest in grazing ecology for the three-year duration of the project. Such a post was advertised nationally, interviews held during January and Dr. Mike Kennedy, a hydrologist/plant ecologist was appointed with effect from 1 March 2005.

Since this appointment has been delayed for almost a year, a rescheduling of the reporting requirements of the project was successfully sought from Sarah Moon at DEFRA. There was no corresponding request to reschedule Darwin funding, since the flexibility of the funding arrangements from the co-funder, The Holly Hill Trust (HHT) means that Mike Kennedy's salary will be available for the fourth year of the project from the Trust's contribution to the project.

4. Progress

• Please provide a brief history of the project to the beginning of this reporting period. (1 para)

The need for the project was identified during a visit by the project leader to KNP, at the invitation of and sponsored by the HHT, to assess the research and tourism potential of a colony of ca. 8 million straw coloured fruit bats which is established seasonally in the mushitu evergreen swamp forest. It became clear during the visit that both the conservation management in the park, particularly the management of wetlands, and the exploitation of natural resources in the surrounding area, were lacking scientific underpinning and informed planning. Local educators and tourist guides lacked ecological and conservation knowledge, needed to influence communal resource management practices and to exploit the area's distinctive tourism attractions.

• Summarise progress over the last year against the agreed baseline timetable for the period and the logical framework (complete Annex 1). Explain differences including any slippage or additional outputs and activities.

Preparation of work plan for the scientific investigations:

Activities have continued which are which are central to fulfilling the purposes of the project (see Annex 1).

Dr. Mike Kennedy made an initial reconnaissance visit to Kasanka National Park from May 20th to June 5th 2005. As a result, sites within the park representing a variety of freshwater wetland habitats (Lake, river and seasonally inundated floodplain and dambo wetlands) were identified with input from the park manager for intensive hydrological study. Each site was visited during the initial visit to measure

conductivity, and samples were returned to the UK for alkalinity (Aberdeen) analysis and oxygen isotope analysis (Scottish Universities Environmental Research Centre: East Kilbride). Potential sites for burning trial plots were also identified within the park (i.e. woodland and dambo sites) and a preliminary experimental site was established within the Kasanka floodplain consisting of replicated 50x50m plots which would be subject to early burn, late burn and no burn treatments. Plots were delineated by mowing firebreaks around them and corners were marked by wooden posts.

Other progress

Guide training has continued successfully with the appointment of Leslie Reynolds by KTL.

A candidate (Gryton Kasamu) was identified by ZAWA and successfully put forward as a candidate for the second MSc post at DICE

- Provide an account of the project's achievements during the last year. This should include concise discussion on methodologies and approaches by the project (e.g. research, training, planning, assessment, monitoring) and their consequences and impacts as well as results. Please **summarise** content on methodologies and approaches, and, if necessary, provide more detailed information in appendices (this may include cross-references to attached publications).

• Research approach and methodologies

Mike Kennedy returned to KNP on 23rd August 2005. Professor C. Soulsby and Dr. G. Iason visited KNP 31st October – 9th November 2005.
During this visit they addressed two main aims (A & B) and two subsidiary aims (C & D). The two main aims were, in conjunction with Mike Kennedy, to finalise the protocols for and implement the two main aspects of scientific fieldwork:

A. Sampling regime to establish the hydrological characteristics of the KNP

A full hydrological sampling regime was finalised and implemented and is planned to continue till late 2007 (or will be ongoing if a funding is obtained for a replacement post). See Appendix 1.

Since returning to the park in August Mike Kennedy has continued sampling of water bodies around the park (see Appendix 2), and five new rain gauges have also been installed at sites across the park to supplement the three that were already present. These are all at manned sites and have been read daily. These will be maintained during the 2006/7 rainy season and supplemented with new gauges (recently purchased in Lusaka) at schools within the GMA. Local knowledge (and data going back to 1987 for Wasa camp and collated by Mike Kennedy and Paul Rehying) suggests that rainfall this year has been higher than the average for the last five or six years. New Rainfall data for 2006 also suggests that the rainfall for the central areas of the park (e.g. Wasa camp) are lower than for peripheral areas such as Luwombwa camp and Kasanka research centre. Also whilst temporal patterns of rainfall are consistent between areas of the park, amounts vary spatially.

Water sampling was undertaken on September 6th 2005, and again on 14th October 2005 (with samples collected for analysis in the UK, plus conductivity and pH on

site). Since 14th October (and with the beginning of the rainy season) sampling visits have been made fortnightly to take pH and electrical conductivity measurements, with samples collected monthly for alkalinity and oxygen isotope analysis in the UK.

Electrical conductivity and alkalinity are useful tracers of where waters are sourced from. Conductivity reflects the concentration of dissolved solutes in water samples, whilst alkalinity indicates the strength of geochemical weathering activity. Low conductivity and alkalinity implies a strong influence of recent rainfall, whilst higher conductivity and high alkalinity is indicative of longer times in contact with catchment soil and geological formations in groundwaters. Measuring oxygen isotope ratios in waters allows further discrimination of water sources. Such tracers are particularly useful in assessing hydrological processes over extensive areas as they act a chemical "fingerprints" of where water has been.

Alkalinity measurements will eventually be carried out at the Kasanka research centre lab, but there is currently a delay in the delivery of sulphuric acid, needed for the analysis, from South Africa. In the meantime all samples have been returned to the UK.

A total of thirty sites have been sampled to date, with seasonal streams being sampled as and when wetting up occurred. Most of these sample sites are out with the park boundary, but ultimately feed into the park. Groundwaters from two boreholes and five well sites are also being monitored, with water level, depth and temperatures recorded in addition on a fortnightly basis for the wells.

Whilst rains started in the park during November 2005, they were generally sporadic and light until mid December. There appears to have been a lag effect with most wells beginning to recharge only several weeks after the onset of the rainy season (i.e. mid-December), with a gradual dilution till February 2006 (represented by decreasing conductivity values). Rivers have also appeared to be fed by rainwater rather than groundwater, with conductivity values dropping in the main channels sampled by early January. Data from alkalinity and oxygen isotope analysis will help to clarify this. A similar pattern has been seen within a number of the enclosed dambos surrounding the main Wasa camp. However, recharge has lagged behind that seen in the main river channels and conductivity has not dropped as much, perhaps suggesting a greater influence of groundwater recharge, combined with a rainwater input.

In addition to the routine sampling being carried out around the park, further hydrological sampling is being carried out in order to fully integrate the ecology and the hydrology of the wetland systems. Full details are provided in Appendix 1.

Monitoring of the mushitu woodland and Kasanka floodplain at Fibwe has been interrupted due to extreme flooding during the 2005/6 rainy season and the presence of crocodiles. Sampling will recommence when floodwaters have receded.

B. An experiment to investigate the effects of timing of burning on vegetation structure, and associated biodiversity.

The protocol for this experiment was finalised (Appendix 1) and in particular the timing of the application of the treatments, degree of replication and spatial locations of experimental blocks, were agreed. It was decided that the greatest risk to the experiment was an inappropriately timed uncontrolled fire. Consequently the experiment is to be distributed such that blocks of different burning treatments that traverse the gradient from miombo woodland to permanently wet grassland, are to be

spatially separated. The experimental design, timing and measurements are given in Appendix 1.

Through accidental burning (in the period between Mike Kennedy's visits) of a majority of the trial plots in the site established on the Kasanka floodplain during June 2005, it became apparent that the plots were too large to manage and were vulnerable to accidental burning. In order to minimise the effects of accidental/unauthorised burning, experimental plots have now been established in the complex of enclosed dambos surrounding Wasa camp (i.e. Wasa I, Wasa II and Lake Kalamba: see Appendix 2). These areas represent good examples of enclosed dambo systems with a well defined hydroseral gradient (from fringing miombo woodland through termitaria grassland, seasonally inundated grassland to permanently wet grassland and open water). They are also surrounded by intact miombo woodland. The dambo and woodland systems appear to have a close hydrological connection and have in the recent past, both been managed by early burning. Appendix 1 shows the layout of each trial block (within which treatments have been randomly allocated) and the hydroseral units which have been identified.

Twenty replicate blocks (i.e. five per habitat type) have there been established. Each block contains and early-burn, late burn and no-burn treatment plot, except for those in the permanently wet grassland, which comprise only controls. These are currently being monitored for a number of vegetation and environmental variables including biomass, vegetation height, average stem density and diameter, soil moisture (these are detailed in Appendix 1). It is hoped that the use of fire-breaks, the proximity to the main camp at Wasa, and the involvement of scouts in monitoring the trials will help prevent unplanned fires. Periodicity of sampling and monitoring will be as shown in Table 2. Early burn treatments are expected to commence in late May/early June 2006, and late burn during late August/early September 2006. Measurements of offtake by grazing animals will commence following the initiation of early burn treatments when exclosure cages will be deployed.

During the visit of Prof Soulsby and Dr Iason, two additional related aspects of the conservation of the KNP and Kafinda Game Management Area were addressed. These were:

C. A feasibility study for a future hydro-ecology research project on the response of sitatunga to hydrological change.

In addition to the super-abundant puku, the relatively large numbers of sitatunga represent a major tourist attraction at KNP, since sightings are virtually guaranteed. This distinctive species is closely associated with wetlands and its distribution and abundance is likely to be affected by any change to the hydrological regime induced by global climate change or altered land use patterns elsewhere in the river catchments outside of the KNP. A series of field visits to Fibwe hide and the Kasanka River areas of the KNP were undertaken to establish the feasibility of a more detailed study of the responses of sitatunga to seasonal and longer-term hydrological change.

During four visits to Fibwe Hide at sunrise on four different days, a mean of 26 Sitatunga were visible per day. A pattern of activity was discernible with some of the animals moving to dense cover after an early morning feeding bout of at least 2.5 hours duration. Three visits to Fibwe before sunset showed the animals to be active and visible again. Two calves aged about 1 month were seen, one of them suckling while its mother was being closely attended and mounted by a mature bull. Other animals were in mainly single sex, smaller groups, although these groups were fluid

and male and female groups merged temporarily. These observations suggest that many aspects of the social system, diurnal pattern of activity and annual reproductive cycle could be effectively studied at Fibwe. However, although vegetation height in the papyrus swamp area at Fibwe was probably at its nadir during the late dry season, animals could only been seen and identified with difficulty, and their departure and arrival from view only logged sporadically using visual observations. Four visits to the Kasanka River floodplain area showed that although sitatunga could be seen (a maximum of seven were counted at any one time), they were very wary of vehicles, could only be watched from a great distance, and moved frequently between patches of tall vegetation, and 'disappeared' from view in undulations in the valley floor. In neither the Kasanka River floodplain nor the Fibwe papyrus area, were the sitatunga using exclusive trails; they always had many optional routes for moving through tall vegetation. Consequently they would not be predictably trappable by any static trapping technique.

It is concluded that in the KNP, data on sitatunga location at an individual level would be best collected using a telemetric method, either radio or GPS-based. This would be most effective in terms of quality of data, and result in less disturbance to the animals, following the fitting of the devices. Immobilisation of the animals would be difficult and time consuming, but possible to achieve. The substantial resources required for the tracking project are being sought elsewhere.

D. Investigation into the rationale for 'late' burning of the woodlands in the Kafinda GMA.

This issue is of relevance to the park managers who consider the relatively late burning in the GMA in August and September conflicts with the earlier burning in KNP, which minimises damage to growing and mature trees, since there is less flammable material on the ground to burn.

Glenn Iason with the help of Frederick Mbulwe, Coordinator of the KNP Community Project established contact with senior members of the local community (Mr Zakeyo Mambwe and Mr Laston Mwangaila) in order to investigate the local harvesting of caterpillars in particular the rationale for the timing of the burning of the miombo woodland harvest. They stated that their management of the woodland by burning is finely controlled within a narrow time window. Burning must take place soon after 25 August; this ensures that there is a flush of new leaves on the trees to provide suitable feeding for the caterpillars when they hatch. Burning too late in September is not desirable since this would both burn the egg masses laid on the bark of the trees, and be too late to permit the trees to flush with new leaves. They stated that the condition of the grass is also important since if it is too long at the time of burning, then the fires can be too hot for the younger trees to survive.

The method of harvesting of the caterpillars involves pollarding trees in order to gain access to their upper branches to strip them of caterpillars. And whilst larger trees may withstand this practise, smaller and younger ones are less likely to, and recruitment to the woodland may be impaired. The caterpillar harvest provides a very important source of revenue and food for the local communities. However, its sustainability is questionable, especially given the degradation of the miombo woodland in areas to the south of Kasanka. The views of Messrs Mambwe and Mwangaila form an important first step in identifying and understanding the problem of sustainable woodland management. The burning and harvesting management practices, should be incorporated into a study which tests their ecological basis, and aims toward the development of a sustainable set of woodland management principles

that will protect the caterpillar harvest. We are attempting to identify funding sources and individual(s) with expertise in ecology and socio-economics to take this forward in future.

Other activities

- *Stakeholders workshop*

Paul Racey and Martin Stanley visited KNP 25th November – 3rd December. A day long stakeholders workshop was held on 1st December, chaired by Mr. Martin Stanley and attended by 17 people as follows:

Name	***Title***	***Organisation***	
Martin Stanley	*Trustee*	*Holly Hill Trust*	*Chair*
Edmund Farmer	*Park Manager*	*Kasanka Trust*	*Secretary*
Hon. Chief Chitambo IV	*Chief*		
Prof. P. Racey	*Professor*	*Aberdeen University*	
C.K. Chisenga	*Chairman*	*Chitambo C.R.B*	
Rita Moono	*R.M.C. Chairman*	*Chitambo C.R.B*	
T. Kapolo	*Secretary*	*Chitambo C.R.B*	
Dr. M. Kennedy	*Darwin Researcher*	*Aberdeen UA/KTL*	
G. Kasamu	*Act. Area Warden*	*ZAWA*	
H. Sambiana	*Park Ranger*	*ZAWA*	
D. Mwela	*District Forestry Off.*	*Forestry Department*	
Derick Chalwe	*Councillor*	*Serenje Dist Council.*	
F.C. Mbulwe	*Comm. Rel. Co-ord.*	*KTL*	
Dolly Chanda	*Comm. Rel. Officer*	*KTL*	
Leslie Reynold	*Guide Trainer*	*KTL*	
H. Richter	*Researcher*	*University of Florida*	
Leigh Chaloner	*Education Volunteer*	*KTL*	

Apologies:

Director-General ZAWA
Director of Research, ZAWA
Serenje District Council Secretary
Area Member of Parliament for Chitambo
Chairman, Kasanka Trust Ltd.

The minutes of this meeting are attached (see Appendix 3). It was notable that the Honourable Chief attended and made a positive contribution since he had been absent from the inaugural workshop.

During the inaugural workshop in 2004, an invitation was extended to ZAWA representatives to nominate a second candidate for training on the MSc course in biodiversity and tourism at DICE. No such nomination had been forthcoming and attention was again drawn to this opportunity.

- *Kasanka Conservation and Research Centre*

Paul Racey and Martin Stanley again toured the Kasanka Conservation Research Centre on the Mulaushi river near the park entrance. Most staff accommodation is complete and the Darwin and community projects are now based there. The major outstanding building project at the Centre is completion of the main building which will be used for presentations and lectures, by the addition of a roof. The progress has been slow because of severe inflation of building costs and the need to obtain additional funding to supplement the original grant from the Beit Trust. The only implication of this for the Darwin project has been deferment of the posters for the walls of this building which Patricia Mupeta planned to prepare.

- *Training*

MSc in Biodiversity and Tourism at DICE

Patricia Mupeta returned to Zambia on 2nd May – 5th July to carry out a research project for her Masters degree which investigated the potential for increasing schools visits to KNP. Her thesis (a copy of which is provided) entitled "Achieving ecotourism goals through educational tourism and conservation education" was accepted by the University of Kent and was the final element in her Masters course. Following its completion Patricia and Martin Stanley visited Aberdeen 14-16th September to discuss the follow through to her project and the next steps in increasing school visits.

Following her return to Zambia, Patricia prepared an application for a PhD course in the University of Florida, and has been accepted and awarded a teaching assistantship from August 2006. She will now return to KNP and prepare the poster boards for the Centre. Meanwhile, a volunteer at KNP, Leigh Chaloner, has picked up the schools project with initial funding from the Holly Hill Trust . The Trust has agreed to kick-start the project with a donation of £8,850 (in addition to the £25kpa to the Darwin project) over a period of six months while further funding is sought. Included in this amount is £3000 for interpretive equipment and materials for the Conservation Research Centre where visitors, tourists and school groups can gain an holistic interactive experience while visiting KNP. The centre, when completed, will house an information bureau, an education display with maps, posters, books, models and interactive games and activities, as well as the full range of audiovisual equipment.

Following the stakeholders' workshop, Gryton Kasamu, acting ZAWA warden for KNP, was nominated by Isaac Longwe, ZAWA's manager of conservation and management services, for the MSc at DICE. In discussions with the director of DICE, Professor Nigel Leader Williams, Paul Racey established that the fact that Gryton has a three year diploma rather than a degree is no barrier to acceptance on the course and that Zambian students with such diplomas have often performed better than those with degrees in the past.

Subsequently Ms Dolly Chanda, community relations assistant at KNP also applied to DICE, on her own initiative and is likely to be accepted on the course, subject to funding. However Darwin project funds are already committed to Gryton Kasamu but Dolly remains a priority if further funds can be identified. She may, for example, be a nominee for a Darwin Fellowship.

Research Assistant

In the inaugural workshop, ZAWA had also been invited to nominate a research assistant for Mike Kennedy, but no such nomination had been forthcoming. As a result adverts for the post were placed in two Zambian newspapers, the Post and The Times, during September 2005. Eleven applications were received. Copies of the advert were also circulated to ZAWA and were again invited to identify suitable candidates, but none was forthcoming. Four candidates were short-listed from replies to the newspaper adverts and were interviewed during November and December and Lackson Chama was appointed and commenced employment on Januray 5th 2006.

In the interval between Mike Kennedy's arrival in August 2006and the appointment of Lackson, Mike had the assistance of four German volunteers within the park when required. A German intern biology student, Paul Rehying, from the university of Applied Sciences, Eberswalde, assisted Mike with hydrological investigations from November 1st 2005 till early 2006.

Victoria Patterson, an MSc student in Aquatic Biosciences from Glasgow University will be undertaking a 9 month placement in KNP beginning in August 2006. She will be undertaking an independent research project during her stay, but will also provide additional support to Mike Kennedy and Lackson Chama.

Resource mapping in Kafinda Game Management Area (KGMA)

During the AGM held by the CCRB during 15th – 17th March it was decided that a resource mapping exercise required the following to be taken into account: the size of GMA, size of population and cartographic information, available natural heritage resources, and land use and management plans for the GMA.

Discussions followed between Fredrick Mbulwe and Mike Kennedy, and it was suggested that a modified version of the UK's former Nature Conservancy Council's Phase I habitat survey could be trialled as a part of the process. This would avoid the need for specialised (e.g. botanical) scientific knowledge by surveyors. Plans are being finalised by project partners in Aberdeen.

Guides

Bob Stjernstedt spent 10 days on guide training in KNP and prepared notes for trainees. KNP recently appointed a new resident guide, Leslie Reynolds, who is now responsible for the ongoing programme of guide training, which has so far involved six trainees: Damson Chola, Marle Katinta, Friday Bwanga, Aaron Mboloma, Kenneth Yotamu and Joseph Mumwenshi.

There has been a notable increase in the levels of interest and knowledge shown by the trainees during the course of training. The training has also benefited from a visit by Derek Solomon, a freelance guide from South Luangwa with expertise in insects and animal tracking. Heidi Richter's also addressed the trainees about the migratory bats which are a major tourist attraction.

The particular interests and strengths of each individual in the program have been identified, and subject matter of their choice provided. A library of references to work from is being compiled and audio cassettes of bird calls have been provided by Bob Sjernstedt.

Leslie has been spending considerable time in the field with the trainees, working on skills such as tracking, the identification of species and the understanding of animal behaviour. The candidates have been encouraged to take detailed notes in the field.

Examples of training and evaluation materials are provided with this report.

•Community Relations

Frederick Mbulwe, who replaced Cornelie van der Feen der Lille as Community Relations Coordinator since the last AR, has been instrumental in the establishment of a nursery for local tree species and chillies. The latter, when dried are used to defend crops against raiding elephants.

Local school children have visited the Conservation Research Centre at Mulaushi to help in the establishment of further trees for a nursery. It is the intention to then involve the children in planting exercises on Zambian National tree day in December.

Repairs to the Forestry Officer's house have been completed, and it is currently occupied by the Community Resource Board Coordinator, who is a key figure in the local community. Although the District Forestry Officer has just been accepted as a student at Copperbelt University, it is hoped that a junior officer from Serenje may still occupy the house.

• *Press and publicity*

A former honours student of Paul Racey, Kieran Dodds became a press photographer on graduating and won the Diageo award in 2005. He sought advice from Paul Racey on places to spend his monetary prize, and decided to photograph the fruit bats at KNP and was present there during the visit of Paul Racey and Martin Stanley. The resulting portfolio won first prize for the nature section of the world press awards (www.worldpressphotos.com) which will be presented in Amsterdam on April 23rd. Announcements of the award were accompanied by a single photograph on web-site but the entire portfolio will be released at the time of the award ceremony. However a several page feature in the Glasgow Herald newspaper, the national newspaper for which Kieran now works, provided good publicity for KNP. Aberdeen University issued a press release on April 7th which was picked up by the Aberdeen Press & Journal and mentions KNP. Hard copies of all the above publicity material are included.

Mike Kennedy has also written two articles since December 2005 outlining what the Darwin Project is (this being the first Darwin project within Zambia) and detailing the specific work of the Darwin project in KNP and the surrounding Kafinda GMA. The first was placed on the KNP website during December, and the second article represents a contributed article within the Chitambo CRB Newsletter. The KNP website has had nearly 10,000 hits since !st January. The first edition of the newsletter is expected to be circulated globally (but mainly within Zambia) by May 2006. Both articles are provided with this report (see Appendices 4 and 5).

Mike Kennedy and Lackson Chama met with the Serenje district meteorologist in March and discussed providing rainfall data from the Kasanka Research Centre figures. These data are then likely to appear on Zambian national weather

programmes (e.g. TV news programme weather bulletins). The meteorologist also plans to visit KNP and the Centre with a view to possibly establishing a weather station at the research centre.

- *Expedition*

An expedition group of eleven undergraduate students, two postgraduates and a member of staff (Dr. Kevin Murphy) will be visiting KNP from Glasgow University at various points for a six week period commencing early August 2006. They will also be joined by Professor Magdi Ali, an African freshwater plant expert from the University of Aswan, Egypt. The group is currently raising money from various expedition funding and private sources and has already raised >75% of the funds needed. The group will be independent, having access to their own vehicles and fuel, but will be accommodated at the Research Centre. However, the main thrust of the project will be baseline surveys of freshwater bodies in KNP, and will provide valuable support to the Darwin project (and also to the education project, working with Leigh Chaloner).

- *Project vehicle*

As a result of substantial and sustained effort on the part of Mr. Tadg Wixted then chair of KTL, to register KTL as a charity and then to negotiate with the Zambian Ministry of Finance, the project Landrover was released on October 26th. Tadg also obtained complete remission of 10 months storage charges from the company concerned, which represents a donation to KTL of £3,000. At the time of release there was a shortage of fuel throughout Zambia which was the cause of some concern at the time but that situation is now resolved and the vehicle is in regular use by Mike Kennedy. A code of practice listing drivers and conditions under which the Landrover may be used has been prepared. In Mike Kennedy's absence on home leave from the end of March until the beginning of May, the vehicle is in the care of Edmund and Kim Farmer who will sign it out to named drivers so that Lackson Chama (who does not have a driving licence) can continue the hydrological sampling.

- Discuss any significant difficulties encountered during the year and steps taken to overcome them.

Vehicle access in the initial stages of Mike Kennedy's second visit (see previous section) caused some delay in sampling. An alternative KTL vehicle was secured for use when available until the project Landrover was finally released.

- Has the design of the project been enhanced over the last year, e.g. refining methods, indicators for measuring achievements, exit strategy?

Methodological approaches to the sampling of water and burning experiments were finalised during the visit of Chris Soulsby and Glenn Iason (see Appendix 1).

- Present a timetable (workplan) for the next reporting period.

Timetable for reporting period May-October 2006. See Appendix 1 for full details of sampling protocol.

ACTIVITY	MAY	JUNE	JULY	AUG.	SEPT.	OCT.
Hydrological Sampling	Continue	Continue	Continue	Continue	Continue	Continue
Monitoring of experimental plots	Continue	Continue	Continue	Continue	Continue	Continue
Burning of sample plots	Early Burn	Early Burn			Late Burn	Late Burn
Guide training	Continue	Continue	Continue	Continue	Continue	Continue
Gryton Kasamu begins DICE course					Course starts	

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

- Have you responded to issues raised in the review of your last year's annual report? Have you discussed the review with your collaborators? Briefly describe what actions have been taken as a result of recommendations from last year's review.

The reviewer commented on AR1:

(i) "the project end date has been delayed from August 2007 to March 2008 but the reasons are not presented clearly. It may have been the result of the delayed appointment of Dr. Kennedy however this is not immediately obvious".

On page 3 of AR1, under the heading 'Modifications to outputs and proposed operational plan', we wrote:

The original proposal aimed to appoint a postdoctoral hydrologist for the first 18 months of the project followed by a postdoctoral grazing ecologist for the second 18 months. However, shortly before the (delayed) announcement of the results of the round 12 competition, the post doctoral hydrologist named on the application accepted a post with The Scottish Environment Protection Agency. Rather than seek a replacement immediately, the project leader decided to wait until two other members of project team, Chris Soulsby, a hydrologist and Glenn Iason, a grazing ecologist from the Macaulay Land Use Research Institute (MLURI) had visited KNP to devise a workplan for the hydrological and ecological investigations required and assess the skills required. They concluded that greater continuity in the research aspects of the project would be achieved by appointing a postdoctoral hydrologist with an interest in grazing ecology for the three-year duration of the project. Such a post was advertised nationally, interviews held during January and Dr. Mike Kennedy, a hydrologist/plant ecologist was appointed with effect from 1 March 2005.

SINCE THIS PROJECT HAS BEEN DELAYED FOR ALMOST A YEAR, a rescheduling of the reporting requirements of the project was successfully sought from Sarah Moon at DEFRA. There was no corresponding request to reschedule Darwin funding, since the flexibility of the funding arrangements from the co-funder, The Holly Hill Trust (HHT) means that Mike Kennedy's salary will be available for the fourth year of the project from the Trust's contribution to the project.

(ii) "It is stated in the original application that a newsletter will be produced and sent to 200 recipients. What newsletter is this and who will the recipients be? The provision of such information will add to the value of subsequent reports".

The production of newsletters was delayed until Mike Kennedy had been in post long enough to identify the most appropriate way of doing do. Newsletters have now been produced, are described in an earlier section of this report and are appended.

(iii) "Details of the activities undertaken with the trainee educators were an omission in this report and should be redressed in subsequent reports".

We have included such details in the present report and sent hard copies of some examples of assessment materials to ECTF.

(iv) "To enable future reviews of adequate assess progress, copies of the educational materials produced while under the project should be sent with subsequent reports".

The plan to produce a series of interpretive posters for the walls of the main building at the Kasanka Conservation and Research Centre was put on hold pending its completion, although this has now been reactivated with the return to Zambia of Patricia Mupeta.

An interpretive poster on the fruit bats has been prepared for the tourist reception centre at Wasa.

(v) "The ownership of the two laptop computers, GPS equipment and vehicle at the end of the project is not made clear in the documents. Will they be handed over to the Trust".

Our original application listed under standard output number 20 (which refers to the "estimated value of physical assets to be handed over to the host country"):

3 year old Landrover Defender value £5K

2 laptop computers £400

GPS handsets £100

Reprint collection and similar resource materials

(vi) "The distribution of funds to community projects was not mentioned in the original proposal as planned activities. Is downstream distribution of DI funds permitted particularly without an integrated procedure for selection of suitable recipients and subsequent monitoring?".

The distribution of funds to community projects arose from a suggestion from the then Community Relations Co-ordinator, Cornelie van der Feel de Lille, of the need to ensure that the local community had a "buy-in" to the DI project, and a contribution of $1500 for the renovation of a forestry department house in Chalilo was an appropriate way of achieving this. One of the stated purposes of the project is "alleviate poverty through……enhanced employment…": employees need houses! Looking ahead to the formulation of an integrated fire and water management plan, the involvement of the local community will be vital of such a plan is to become a reality, given the present conflict between the early "cool" burn used for management purposes in the park and the later hotter riskier burn ordered by the Chief in the interests of the caterpillar harvest. We were happy to accept Ms van der Feen der Lille's suggestion and presently enjoy excellent relations with her successor Frederick Mbulwe, who has been very supportive of the DI project. The donation of $1500 was approved by Martin Stanley, trustee of HHT and donor to the DI project, who also visited the community projects, as described in AR1.

6. Partnerships

- Describe collaboration between UK and host country partner(s) over the last year. Are there difficulties or unforeseen problems or advantages of these relationships?

(i) All UK-based personnel associated with the project (Paul Racey, Chris Soulsby, Glenn Iason and Martin Stanley) have again visited KNP . When passing through London, Edmund Farmer also had discussions with Martin Stanley. Patricia Mupeta travelled to Zambia to gather data for her research project, and this involved an extended visit to KNP. Regular email contact is maintained between UK-based personnel and those at KNP, initially via bushmail (involving a slow radio-link of limited capacity and no attachments) and then by VSAT. The latter represented a major advance, and was greatly missed when the modem developed a fault, which is currently being rectified. The centre at Mulaushi is linked to Wasa by radio, but a priority now is to establish an email link for the centre. No difficulties or unforeseen problems have arisen in the partnerships.

- Has the project been able to collaborate with similar projects (Darwin or other) in the host country or other regions, or establish new links with / between local or international organisations involved in biodiversity conservation?

(ii) There appear to be no similar projects operating elsewhere in Zambia. KTL is involved in developing a project with WWF/UNDP as mentioned in AR1, but there has been little progress so far in its implementation.

(iii) .In November 2005, a group of village leaders from North western Zambia was sponsored by the West Lunga Trust to visit The Kasanka Conservation Centre and witness the conservation and research work going on in KNP and Chitambo Chiefdom. In the same month, a group of trainee guides from KNP was hosted by a South Luangwa operator, Chibuli Giudes and Tours, to gain exposure to a different tourism and wildlife environment.

(iv) The Education project has established correspondence with two schools overseas – Yately Manor Primary School in the UK with Misumba Middle Basic School near Chalilo and Beaumaris North Primary School in Australia with Kafinda Middle Basic School near the park gate. It is planned to affiliate the schools so that they learn more about each other and exchange creative writing materials, artwork and photographs.

(v) Paul Racey, through his interest in bat biology, assisted Heidi Richter fix satellite transmitters to straw coloured fruit bats during his visit.

7. Impact and Sustainability

- Discuss the profile of the project within the country and what efforts have been made during the year to promote the work.

The project continues to raise its profile and gain recognition as activities develop and through the annual stakeholders workshop, newsletters, community program contributions, and potential publicising of meteorological data.

- What evidence is there for increasing interest and capacity for biodiversity resulting from the project?

Interest from scouts and other park management staff, local children and adults in the work

- Is there a satisfactory exit strategy for the project in place?

The project is half way through, and we are thinking of developing aspects of the project rather than exiting

8. Outputs, Outcomes and Dissemination

- Explain differences in actual outputs against those agreed in the initial 'Project Implementation Timetable' and the 'Project Outputs Schedule', i.e. what outputs were not or only partly achieved? Were additional outputs achieved?
- Provide details of dissemination activities in the host country during the year, including information on target audiences.

➢ A Darwin newsletter has been placed on the Kasanka website.

➢ The International School in Lusaka visited and was introduced to the work of the project

➢ Mike Kennedy met with representatives from ZAWA and the Forestry Department during their visit to KNP on 26th August 2005 to advise on the potential impacts on freshwater habitats of possible intensive farming activities on upstream sections of perennial rivers feeding into the park. A short document was produced by Mike Kennedy and provided to the representatives (Appendix 6)

➢ A tour of the Kasanka Research Centre was undertaken by a group of the Chiefs advisors during March 2006. The tour was organised by Mr Fredrick Mbulwe, and during the tour Mike Kennedy spoke to the advisors about the work that the project was undertaking, and the role that conserving the valuable freshwater habitats within the park and GMA could play in sustaining local livelihoods. Some of the sampling equipment used was also demonstrated.

➢ Mike Kennedy has talked to scouts on an informal basis to give them a clear understanding of what the project is undertaking and to gain their support in protecting experimental sites.

- Will dissemination activities be continued by the host country when the project finishes, and how will this be funded and implemented?

Please expand and complete Table 1. **Quantify** project outputs over the last year using the coding and format from the Darwin Initiative Standard Output Measures (see website for details) and give a brief description. Please list and report on appropriate Code Nos. only. The level of detail required is specified in the Guidance notes on Output Definitions, which accompanies the List of Standard Output Measures. Only the summarised totals after the end of your project will be recorded on the Darwin project database from your final report (the totals below will help you to keep track on a yearly basis).

Table 1. Project Outputs (According to Standard Output Measures)

Code No.	Description	Year 1 Total	Year 2 Total	Year 3 Total	Year 4 Total	TOTAL
2	MSc student being trained	1		1 planned		
5	Guides trained	5	6			
7	Video produced	1	-			
8	Weeks of residence by postdoctoral scientist	-	30			
8	Weeks of visits by AU,MLURI,& HHT personnel	4	7			
11A	Annual workshop	1	1			
15A	Press release	1	1			
16A	Electronic Newsletter	-	1	1 drafted		
23	Donation from Holly Hill Trust	1	1			

- In Table 2, provide full details of all publications and material produced over the last year that can be publicly accessed, e.g. title, name of publisher, contact details, cost. Details will be recorded on the Darwin Monitoring Website Publications Database. Mark (*) all publications and other material that you have included with this report.

Table 2: 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

- Please expand and complete Table 3.

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

Item	Budget (please indicate which document you refer to if other than your project schedule)	Expenditure	Balance

- Highlight any recently agreed changes to the budget and explain any variation in expenditure where this is +/- 10% of the budget.

10. Monitoring, Evaluation and Lessons

- Discuss methods employed to monitor and evaluate the project this year.

➢ In addition to visits by UK-based personnel to KNP, described elsewhere, the following methods are employed to monitor the project:

➢ Formal monthly reports from Mike Kennedy, detailing the progress of the scientific investigations. Quarterly meetings between Paul Racey, Chris Soulsby and Glenn Iason to discuss progress and forthcoming work.

➢ Two meetings between Patricia Mupeta, Martin Stanley and Paul Racey, a visit by Martin Stanley to Patricia in DICE and monthly phone calls between Paul Racey and Patricia.

- Regular email contact is maintained between UK-based personnel and KNP-based personnel.
- Edmund Farmer produces quarterly reports about KNP which details visitor numbers, poaching pressure, reintroduction initiatives etc

- How can you demonstrate that the outputs and outcomes of the project actually contribute to the project purpose? i.e. what are the indicators of achievements (both qualitative and quantitative) and how are you measuring these?

- The training provided by Bob Stjernstedt and the recruitment of Leslie Reynolds to continue guide training is contributing to project purpose bullets 2 & 3 and part of 5.
- The fact that both the DI project and the Community Project are based at the Kasanka Conservation and Research Centre, where Mike Kennedy is also provided with a house has enabled him to establish excellent relations with the community project. Staff from the project have been eager to learn what Mike's hydrological investigations can contribute to the future of the park.

- What lessons have you learned from this year's work:

- That attempts to lever additional funds for hydrological investigations have proved much more difficult than for species-based conservation biology in other Darwin projects. Chris Soulsby reapplied to The Ralph Brown Award administered by The Royal Geographic Society and despite being shortlisted, did not receive an award.
- Airfares were underbudgeted on the original application.
- The cost of the research project, undertaken during the MSc at DICE, which included a visit to Zambia, incurred a significant extra cost to the project. DICE provide £300 per student (which is in line with most UK universities) but an additional £1000 was made available to Patricia for hire car charges and other in-country transport costs.

- And can you build this learning into future plans:

- Only by asking for more money on future applications of a similar nature

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

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

In this section you have the chance to let us know about outstanding achievements of your project over the year that you consider worth highlighting to ECTF and the Darwin Secretariat. This could relate to achievements already mentioned in this report, on which you would like to expand further, or achievements that were in addition to the ones planned and deserve particular attention e.g. in terms of best practice. The idea is to use this section for various promotion and dissemination purposes, including e.g. publication in the Defra Annual Report, Darwin promotion material, or on the Darwin website. As we will not be able to ask projects on an individual basis for their consent to publish the content of this section, please note the above agreement clause.

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 build capacity to conserve biodiversity of KNP by developing hydrological and fire management plan for sensitive ecosystems. To uplift management of KGMA resources. To improve conservation education. To alleviate poverty.	New knowledge of hydrological relations between rivers, lakes, swamps and grassland in KNP. New knowledge of distribution and behaviour of a large grazer (sitatunga) in relation to habitat. Cross sectoral cooperation in the planning of KGMA resource utilisation. Improved conservation experience for visitors.	Water sampling and vegetation sampling underway in KNP. Plans being developed for KGMA resource mapping exercise. Involvement/ education of park staff and local communities (including school children) in DI project. Wider promotion of project amongst tourists and other Zambian institutes.	Continuation of sampling. Implementation of resource mapping exercise.
Outputs			
Production of fire management plan and manual	Data generation from baseline monitoring of waterbodies and experimental plots.	Baseline data collection ongoing. Sampling protocol supplied to Darwin.	Expansion of rainfall monitoring activities to include sites outside of KNP but within KGMA
Restoration of water levels in mushitu and papyrus swamp.	Data generation from baseline monitoring.	Baseline data collection ongoing. Sampling protocol supplied to Darwin.	Maintain monitoring
Two Zambian staff trained in tourism and conservation at DICE.	Successful completion by first candidate and successful applications for second position.	Patricia Mupeta completed during 2005; Gryton Kasamu accepted for 2006 intake; Dolly Chanda accepted by DICE pending funds being secured. Completed MSc thesis (Patricia Mupeta) supplied to ECTF.	Second student to commence training during 2006.

Nine local staff trained as environmental educators and guides	Field based training and examination underway	Leslie Reynolds employed by KT and active in local staff training for. Training materials supplied to Darwin.	Selection and training of remaining staff
Resource database for KGMA.	Training of local survey staff in monitoring techniques and production of resource map.	Discussion of approaches to mapping between M. Kennedy (DI) and CCRB members. Outline proposal supplied to Darwin.	Development and finalisation of techniques for mapping and staff training.

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.

Appendix 1 Mike Kennedy, November 2005

Specific Research Plan for Hydrological Sampling and Burning Experiment at Kasanka

1. Project aims

The flagship habitats within Kasanka can be considered to be: (i) the wet evergreen (Mushitu) woodland, (ii) Papyrus swamp, (iii) seasonally inundated dambos and their associated catchments (i.e. fringing miombo woodland), and (iv) River, lake and freshwater habitats.

The main potential threats to these habitats are considered to be:

(1) Hydrological change resulting from reduced rainfall and increased temperatures (i.e. global climate change).
(2) Potential hydrological and/or hydrochemical change resulting from increased surface or groundwater abstraction and/or eutrophication and pollution of surface and groundwater bodies by fertiliser and pesticide application outside of the park, but within the wider catchment(s) of the park (e.g. possible commercial farming developments)
(3) Under-burning of woodlands and neighbouring grasslands, and consequent large-scale destructive 'natural' burning of woodlands, resulting from accumulated high fuel loads (with remaining fragments of mushitu woodland being particularly vulnerable)
(4) Possible long-term negative impacts of high frequency of burning (e.g. soil nutrient deficiency, diminished primary productivity).

The overall primary objectives of the project are therefore:

(1) To investigate the relationship(s) between hydrology and grazing patterns (as measured by primary productivity) in seasonally inundated grasslands
(2) To investigate (and establish) ecological consequences of frequency (year to year) and timing (early and late season) of burning. This relates to soil nutrient status, primary productivity, and plant community characteristics, and relative utilisation by large herbivores. This is implicit to all habitats that are currently subject to burning regimes, including miombo woodlands, floodplain grasslands, termitaria grasslands, and seasonally inundated dambo systems.
(3) To generate a detailed understanding of the hydrological pathways and relationships within the park as a whole, and between the various key habitats.
(4) To generate a detailed understanding of the hydrology and hydrochemistry underpinning key habitats within the national park (specifically remnants of wet evergreen mushitu forest).

By addressing these main objectives, the work plan will illustrate interactions between hydrology, burning regime, and associated large herbivore utilisation within KNP. This should provide a scientific basis with which to underpin an appropriate management plan for the KNP, and potentially for similar national parks and GMA's.

2. Methodological Approach

2.1 Burning trials

Burning trials will be concentrated around Wasa I and Wasa II as these two areas represent good examples of enclosed dambo systems with a well defined hydroseral gradient (see Table 1). They are also surrounded by intact miombo woodland. The dambo and woodland systems have a close hydrological connection and are both currently managed by early burning. Figure 1 shows the layout of each trial block (within which treatments will be randomly allocated at the outset), while the hydroseral units, which have been identified, are outlined in Table 1.

Five replicate blocks will be used, which will be spread around Wasa I and Wasa II as an insurance against uncontrolled fires. However, it is hoped that the use of fire breaks, the proximity to the main camp at Wasa, and the involvement of scouts in monitoring the trials will help prevent unplanned fires. Periodicity of sampling and monitoring will be as shown in Table 2.

Table 1 Sequential hydroseral units identified within enclosed dambo and surrounding miombo systems.

Unit	Features	Treatment plots
Open Water		None
Permanently wet grassland	- Permanently wet, but likely to be periodically flooded.	Control (no burn) only
Seasonally inundated Grassland	- Sufficiently dry to allow burning between May and early August. - Evidence of burning still visible at onset of rainy season.	Control, Early burn, Late burn.
Termitaria	- Very little or no prolonged inundation.	Control, Early burn, Late burn.
Miombo woodland		Control, Early burn, Late burn.

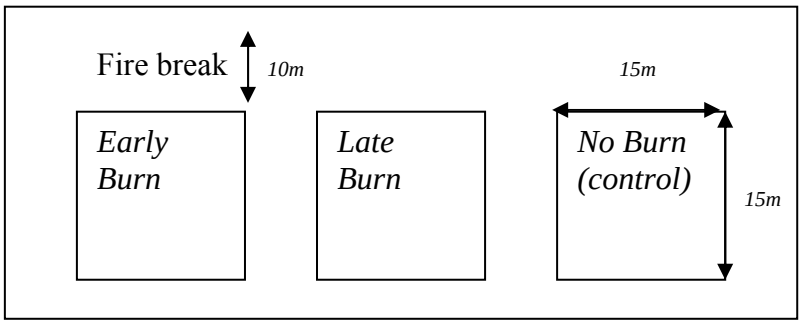


Figure 1 Arrangement of treatment plots within blocks. Blocks will be replicated within Wasa I, Wasa II and Lake Kalamba.

2.2 Monitoring vulnerable key habitats and general hydrology

The main block of mushitu woodland borders an area of Papyrus and mixed vegetation swamp (Kapabi Swamp). Both these habitats will be monitored as outlined in Table 3.

The area of mushitu forest remaining is becoming depleted due to repeated burning out of underlying peat deposits. In order to compare to a previous (2001) survey, the perimeter of the remaining woodland fragments will be walked and referenced in using a GPS device.

A general soil moisture and depth survey will be carried out on the fringes of the woodland to estimate the potential for seedling regeneration (initial soil surveying during November 2005 established that in certain areas the apparently abrupt boundary edge of the woodland might be due to very thin soils overlying bedrock. In other areas much of the underlying peat deposits appear to have been lost to fire. If time allows (and potentially suitable soil deposits are located) then exclosures from grazing and burning will be established on the fringes of the mushitu forest to investigate the potential for seedling regeneration.

Hydrological and hydrochemical measurements will be made within key habitats such as the mushitu forest and swamp areas, as well as more generally across the park. These are shown in Table 3.

2.3 Sub projects

There are a number of further projects which may provide additional useful information and may be undertaken if time allows, student (or long term volunteer) support is forthcoming, and appropriate links can be made to Universities and research centres in Zambia. Many of these have been discussed already.

Table 2 Proposed **v**egetation and general environmental variables to be measured per 15 x 15m trial plot.

Component Measured	**Periodicity of Sampling**	**Details**
Species composition	- Quarterly	- Standard assessment of species cover within a sub-divided 1x1m quadrat. Replicate samples will be stratified within each plot.
Species richness (s)	- Quarterly	- Stratified replicate measures within a 1x1m quadrat.
Stem density	- Quarterly	- Measured within a smaller (20cmx20cm) quadrat, replicated within each larger 1x1m quadrat.
Sward height	- Quarterly	- Ten replicated measurements per larger sample plot
Primary production (offtake trials)	- Monthly (wet/growing season) - Quarterly (dry season)	- Rolling cage method will be used, with one cage per plot and paired 1mx20cm vegetation samples (inside and outside of cage) taken.
- Biomass/ necromass	- Monthly (wet/growing season) - Quarterly (dry season)	- Samples from offtake trials will be sorted to species level and fresh weight measured. Samples will then be air dries until weight remains constant.
- Protein analysis (palatability)	- Monthly (wet/growing season) - Quarterly (dry season)	- Samples to be returned to Macaulay for analysis pending ZAWA licence
Dung counts	- Monthly (wet/growing season) - Quarterly (dry season)	- Three stratified 5x1m strips (initially: may need to increase resolution) per sample plot.
Soil description	-Yearly	- Basic description, replicated at each site: i.e. mineral (clay, silt, sand), or organic; horizon depths.
Soil permeability (permeator)	- Quarterly	- Replicated sampling within each treatment plot.
Evaporation Trials	- Yearly (During period of burning)	- Fire intensity to be monitored by degree of evaporation during treatments.

Table 3 Proposed hydrological and hydrochemical measurements to be taken.

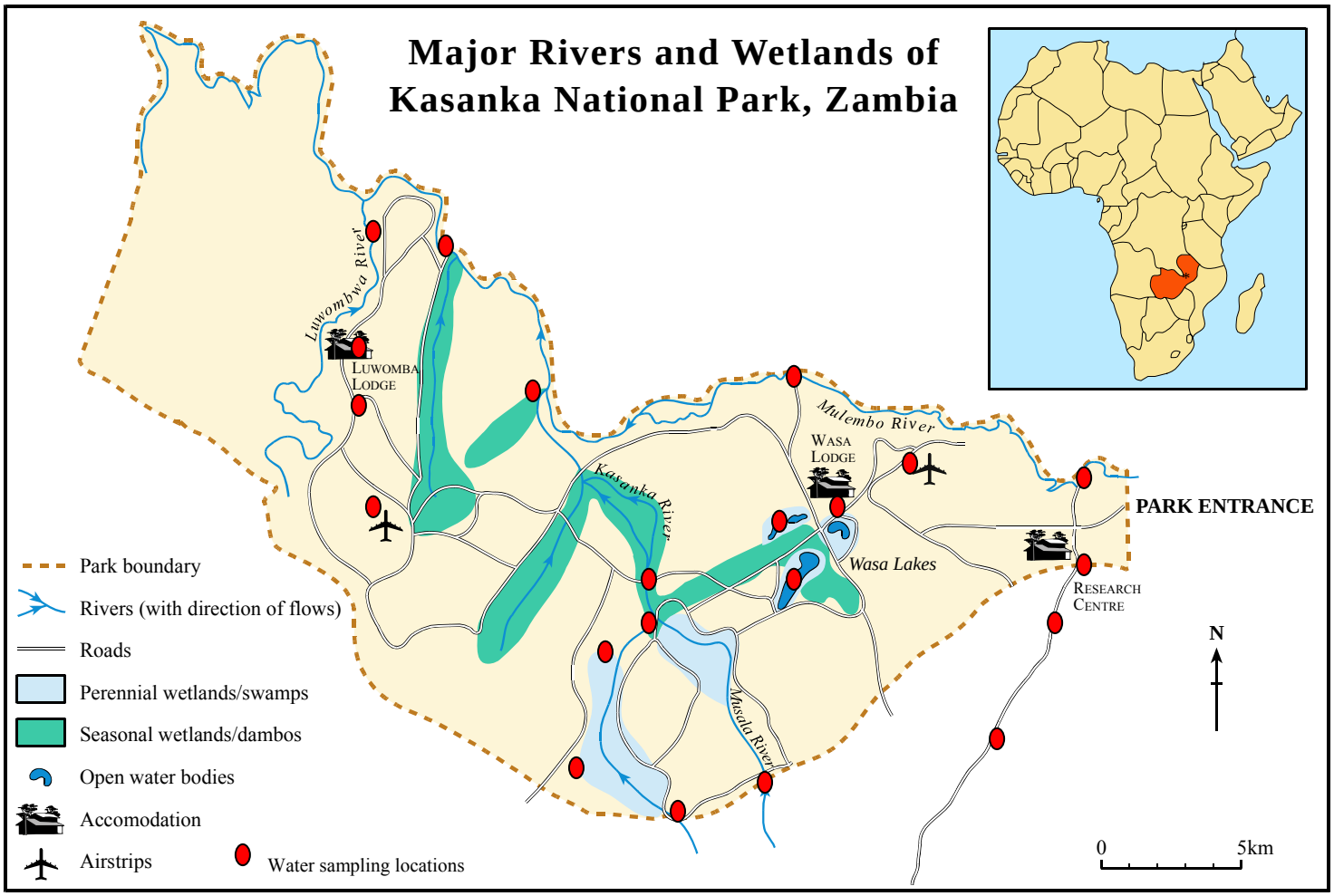
Component Measured	**Sample Locations**	**Periodicity of Sampling**	**Details**
Precipitation	- Wasa Camp - Mulaushi Camp - Luwombwa Camp - Chikufwe Airfield - Mulembo Airfield - Fibwe Hide - Kasanka Pontoon	Daily	- Five new 100mm rain gauges purchased to supplement those already in place at Wasa, Luwombwa and Mulembo airfield.
Evaporation	- Mulaushi Camp	Daily	- Open pan method to assess daily water loss through evaporation.
River levels	- Kasanka pontoon - Mulaushi Camp	Daily	- Diver deployment with potential for hourly readings at Kasanka Pontoon.
Dambo Characteristics	- Mulaushi Camp	Daily	- General observations of wetting up and commencement of overland flow. - Less frequent but similar observations at other dambos as and when visited.
Soil moisture (Portable Capacitance probe)	- Within burning (and control) trial plots	Fortnightly	- A minimum of ten measurements per trial plot in each of the main dambo, termitaria and miombo woodland areas identified for investigation.
	- Fibwe Mushitu Forest	Quarterly	- General surface moisture assessment of main forest and edge areas with sample transects referenced in with GPS.

Table 3 (continued)

Component Measured	**Sample Locations**	**Periodicity of Sampling**	**Details**
Soil moisture (Tensiometers)	- Fibwe Mushitu forest	Fortnightly (more frequently if a reliable scout can be found)	- 5 nests arranged in transect through the woodland. Nest formation will allow readings to be taken from depths of 30cm, 60cm and 90cm below ground surface.
Soil permeability (Permeametor)	- Fibwe forest - Wasa I - Wasa II - Kapabi swamp - 26 hydrological sampling locations	Occasional intensive field surveys	- To be determined on a site by site basis.
Groundwater levels (Wells)	- Mulembo airfield - Chikufwe airfield - Wasa kitchen - Wasa garden	Fortnightly	- Water levels recorded against a standard datum.
Groundwater levels (Dipwell transects)	- Fibwe Mushitu forest - Kapabi swamp - Wasa I - Wasa II	Fortnightly	- Dipwells arranged 10 per transect. - In conjunction with tensiometer nests at Fibwe and at an accessible location at Kapabi. - Across hydroseral sequences at Wasa I and II to aid site characterisation in conjunction with burning trials
pH, Conductivity, Alkalinity and $\delta^{18}O$	- 26 Hydrological sampling locations (river, lake, groundwater and wetland sample points across park).	- Fortnightly (wet season) - Monthly (dry season)	

Appendix 2

Map showing approximate sampling locations (Note that some sites have multiple sampling points in close proximity)



Appendix 3

Conservation of Wetlands and Associated Biodiversity in Northern Zambia

Minutes of the Annual Stakeholder workshop held at Kasanka National Park

1st December 2005

Present:

Name	***Title***	***Organisation***	
Martin Stanley	*Trustee*	*Holly Hill Trust*	*Chair*
Edmund Farmer	*Park Manager*	*Kasanka Trust*	*Secretary*
Hon. Chief Chitambo IV	*Chief*		
Prof. P. Racey	*Professor*	*Aberdeen University*	
C.K. Chisenga	*Chairman*	*Chitambo C.R.B*	
Rita Moono	*R.M.C. Chairman*	*Chitambo C.R.B*	
T. Kapolo	*Secretary*	*Chitambo C.R.B*	
Dr. M. Kennedy	*Darwin Researcher*	*Aberdeen U./KTL*	
G. Kasamu	*Act. Area Warden*	*ZAWA*	
H. Sambiana	*Park Ranger*	*ZAWA*	
D. Mwela	*District Forestry Off.*	*Forestry Department*	
Derick Chalwe	*Councillor*	*Serenje Dist Council.*	
F.C. Mbulwe	*Comm. Rel. Co-ord.*	*KTL*	
Dolly Chanda	*Comm. Rel. Officer*	*KTL*	
Leslie Reynold	*Guide Trainer*	*KTL*	
H. Richter	*Researcher*	*University of Florida*	
Leigh Chaloner	*Education Volunteer*	*KTL*	

Apologies:

Director-General ZAWA

Director of research, ZAWA

Serenje District Council Secretary

Area Member of Parliament for Chitambo

Chairman, Kasanka Trust Ltd.

Martin Stanley (MS), Trustee of the Holly Hill Trust, (Co-sponsors of the project) was asked to chair the meeting, and called the meeting to order at 1415.

The Chair, Martin Stanley	*Reminded the meeting of the purposes of the Darwin Project to support research, training and conservation in Kasanka national park and beyond, and that there had been an inaugural workshop held a year ago. The project was now fully under way and he called on on Prof Racey, the project leader to review progress.*
Prof Racey	*Explained that the Darwin initiative was established by the British Government 12 years ago to comply with its obligations towards protection of biodiversity. The Initiative aims to assist countries rich in biodiversity but poor in finance with institutional capacity, applied research and training. PR summarised progress since the last workshop:* *<u>Community Development</u>* *The project had agreed to allocate $1500 per annum directly towards community development in the Chitambo Chieftaincy. In 2005 this was used towards the renovation of the forestry department house in Chalilo. This is now complete* *<u>Sponsorship to Masters Degree</u>* *Patricia Mupeta, the first candidate identified has now completed the Masters degree in Tourism and Conservation at DICE. The 2nd place had been offered to ZAWA to identify a candidate during 2005, but none had been put forward. The offer was again made to ZAWA to put forward a suitably qualified candidate. If ZAWA cannot manage to do so before February 2005 then the project will look elsewhere for a suitable candidate.*
	<u>Local Training</u> *Training of tourism guides and local conservation educators had proceeded well with the appointment of Leslie Reynolds to lead*

	the program. 4 trainees had been receiving training from within KTL management and from 2 outside experts, Bob Stjernstedt and Derek Solomon. There were plans to arrange some training and familiarity visits to South Luangwa before the end of the year. *<u>Research Work in Kasanka</u>* *Dr. Mike Kennedy was appointed to the research fellowship in March 05. He visited Kasanka in May/June and then took up permanent residence in August 05. He has commenced study work on the hydrology and fire ecology of Kasanka with the aim of providing better scientific knowledge to guide management activities. The new Landrover for the project had been shipped from UK and is now operational with Dr. Kennedy.* *Prof. Chris Soulsby (Hydrologist) and Dr. Glenn Iason (grazing ecologist) visited from Aberdeen in November to review progress and guide the research programs. They assisted to identify critical habitats of miombo, Mushitu, dambos, rivers and lakes and their associated threats including reduced rainfall, disturbances from outside the park (e.g. damning and pollution of rivers from nearby planned Nasanga farm block on Luwombwa river), under, over, early and late burning regimes. It is hoped that results from this research will eventually be available to guide environmental management in Kasanka and similar habitats elsewhere.*
Dr Kennedy	*Spoke further regarding the habitats present within the park, the critical nature of these habitats and the potential treats to their maintenance. A document outlining the habitats to be prioritised in the Darwin research and details of the research to be undertaken was circulated to the*
The Chair	*Opened the floor for comments and questions*
F. Mbulwe	*Pointed out the specialist nature of the training for conservation educators and called on all those with special skills to assist in the ongoing training so as to provide as broad a knowledge base as possible.*
Hon. Chief Chitambo	*Asked what the entry requirements were for the Masters degree candidate, how the opportunity would be advertised and whether the successful graduates would be employed in Kasanka afterwards.*
Prof. Racey	*Answered that the sponsored candidate preferably should have a 1st degree in a relevant subject. The place had been offered first to ZAWA as institutional support and also because ZAWA staff members were considered more likely than others to return to Kasanka or at least to conservation in Zambia.*
D. Mwela	*Asked if the forestry department could submit applications for the MSc. course.*

Prof. Racey	*Responded that they would be welcome to do so, but reminded him that first choice had been offered to ZAWA as KTL's primary partners.*
E. Farmer	*Responded that ZAWA would be given first chance as they are the main working partners in the park. However, nominations will potentially be considered from elsewhere.*
F. Mbulwe	*Asked how often workshops like the present one would be held.*
Prof. Racey	*Replied that stakeholder workshops were planned for once a year. It would be difficult and expensive to hold them more often as some people had to some from overseas. However an electronic newsletter would be produced and included in KTL's quarterly report from now on.*
G. Kasamu	*Asked if ZAWA could put forward a research assistant candidate as a ZAWA employee would assure more continuity after the end of the research fellow's contract.*
Prof. Racey	*Agreed, but advised that after several invitations and reminders ZAWA had not identified any candidate so the project had been forced to advertise publicly and selection was now underway from general applicants. Any integrated fire and water management plan will need to be approved by ZAWA, and the individual eventually employed will be trained in all appropriate techniques.*
	TEA BREAK
The Chair	*Explained that the research project carried out by the first MSc student Patricia Mupeta had looked at educational tourism in Kasanka focussing on the educational value and income generation potential of Kasanka.*
Leigh Chaloner	*Discussed her voluntary work with the schools near Kasanka and that she would like to stay longer and concentrate on the Community schools who are in need of a lot of support.*
Heidi Richter	*Outlined the research she is doing on bats in Kasanka including the fitting of satellite tracking devices to 4 Straw Coloured Fruit Bats.*
Prof. Racey	*Invited a discussion of what gaps remained between the project plan and implementation to date.* *Resource mapping and sustainable use plans for natural resources in the Chieftaincy were to be assisted by the Darwin project. Although no specific budget was allocated for this Dr. Kennedy has a brief to facilitate the work with his expertise and general project resources. So far KTL and CCRB have done a pilot inventory of forestry in the Katonga area and a social survey of*

	the whole chieftaincy is nearly completed with funding from the Netherlands IUCN.
Charles Chisenga	*Said that teaching materials were needed for an environmental awareness campaign.*
Edmund Farmer	*Responded that the intention was to source such materials to be based at the new Conservation /Education centre at Mulaushi and these could be used in situ or for educational tours.*
The Chairman	*There being no other matters arising, the Chair asked for a list of agreed actions be drawn up. The following were thereby agreed by all those present:*
	<u>AGREED ACTIONS</u> 1. *Human effects on the environment such as burning and fish poisoning to be assessed.* 2. *More regular dissemination of information about the project included in KTL's quarterly reports.* 3. *Copies of all training material for guides/conservation educators to be supplied to the project leader.* 4. *More support be given by the project for resource inventory work in the Game Management Area around Kasanka.* 5. *Broadening of current guide training to include conservations educators as well as tourist guides.* 6. *Identify 2nd Masters student with ZAWA to be given first refusal.* 7. *Research assistant to be employed as soon as possible.*
	The meeting was closed at 1530

Appendix 4

Darwin Initiative Newsletter (December 2005)

The Darwin initiative, a programme aimed at biodiversity conservation and increasing awareness of conservation issues through research and education in developing countries, has come to Kasanka. The UK government funded initiative came into being following the Earth Summit held in Rio de Janeiro during 1992 (see www.darwin.gov.uk for full details of the programme). A project entitled 'Conservation of Wetlands and Associated Biodiversity in Northern Zambia', currently underway in Kasanka National Park represents the first project funded under the Darwin initiative to be based in Zambia. The project is also partly funded by the UK based Holly Hill trust, and is administered through the University of Aberdeen in the UK.

An inaugural workshop was held in November 2004, and was attended by representatives of local dignitaries, local and national government representatives, and members of the local community resource board and the Kasanka based Community Project. Both the CRB and the community project have had an ongoing working partnership with the Kasanka Trust and are seen as central to bringing conservation education to local communities whilst maintaining sustainable livelihoods. It is envisaged that the Darwin project will work closely with these organisations, and with school based education projects run through Kasanka Trust. The workshop was also attended by the park Manager, Mr Edmund Farmer, the principle investigator from Aberdeen University, Professor Paul Racey, and the Holly Hill trustee, Mr Martin Stanley.

The project began in earnest in 2004 with the training of Kasanka Scouts in conservation issues, and this continued during 2005. The training was begun by the bird expert Bob Stjernstedt, and was taken over by Leslie Reynolds, an experienced bush guide with a good eye for spotting wildlife. Les has been employed by Kasanka Trust since July 2005. The scout training is still underway and will continue for at least the duration of the current Darwin Initiative project funding (currently scheduled to finish in early 2008), with the aim of training three scouts per year.

One of the aims of the Darwin project has been to identify excellent Zambian graduates to go onto the M.Sc. in Tourism and Conservation at the internationally renowned Durell Institute, based at the University of Kent in the UK. Two studentships were made available as part of the funding for the Darwin project, and Patricia Mupeta, a graduate in Biological Sciences from the University of Zambia, who has previously worked for the Wildlife Conservation Society, was the first to take up a studentship during 2004. Particia undertook project work looking at ways of increasing school level involvement within Zambian national parks such as Kasanka as part of her M.Sc. project. As of November 2005 Patricia has returned to Zambia and is awaiting the results of her long hours of study – good luck!

The main research thrust of the project began in August 2005 with the Arrival of myself, Dr Mike Kennedy. I was appointed as post-doctoral researcher on the project in March 2005, and had a two-week visit to the park during May and June 2005 to clarify research priorities. Briefly, my background is a first degree in Plant Biology, followed by a Masters degree in Environmental Science, and a PhD in wetland Plant ecology. I have also previously worked for the Scottish Environment Protection Agency (SEPA) on freshwater sampling issues, and on a two-year research project looking at the role of wetland systems in maintaining water quality in the UK. This background should help in undertaking the kind of multi-disciplinary work that is required in Kasanka National Park as part of the Darwin project. The office for the Darwin project is now up and running at the new Kasanka Conservation centre (on the

Mulaushi River near to the main entrance to the park), and I am now fully installed there. The new laboratory is also nearing completion, and water quality testing will be routinely carried out here. It is the intention that other groups (either long term researchers or short term expedition groups) will use the facilities that have been set up. We have also now taken possession of a Land Rover. This will be dedicated to the Darwin project, and will eventually be donated to the Kasanka Trust. On a personal note, I have been struck by the friendliness of the Zambian people and the interest shown in the project.

Chris Soulsby, Professor of Hydrology at Aberdeen University, and Dr. Glenn Iason, an expert in Grazing ecology from the Macaulay Land Use Research Institute (MLURI) in Aberdeen are acting as advisors on the project and visited Kasanka for ten days during October and November 2005. The visit was very successful and allowed research plans to be finalised. It was decided that burning trials should be concentrated around the complex of enclosed dambo systems around the main Wasa camp. This will allow close monitoring of the trials, and will hopefully prevent accidental/illegal burning of the trial plot areas. The trials will contrast early burning, late burning, and absence of burning, in various dambo habitats and surrounding miombo woodland, and the consequences for vegetation development, preference by large Grazers such as Puku and soil conservation. Certain specialist equipment will be deployed following burning, and information leaflets will be placed in visitor chalets and at the Kasanka Conservation centre to keep visitors informed of the active research taking place in the park. Chris will be putting together an application for funding for a detailed hydrological study during large storm events, hopefully to commence during the 2006/2007 rainy season. This will hopefully complement the baseline studies being undertaken by myself. Glenn is also pursuing funds to undertake a future study of Sitatunga behaviour in the park.

We have also been setting up several other monitoring schemes within the park. These include intensive studies of hydrological dynamics within a single dambo system near the Conservation centre, the installation of rain gauges at new sites, monitoring of daily evaporation at the Center (to get a better idea of the overall water balance in the park), and hydrological monitoring of the floodplain swamp areas. Monitoring will commence in the wet evergreen Mushitu woodland once the famous Kasanka Straw-Coloured fruitbats have left for new feeding grounds. It is hoped that we can map the remaining areas of woodland, and get an idea of the local hydrology in order to halt the decline of the woodland. Paul Reyhing, a student from the University of Applied Science in Eberswalde, Germany has been helping in the set up of the various trial plots and monitoring schemes. He will be based in Kasanka until February 2006. Intensive water sampling at twenty-six locations around the park is also being undertaken at fortnightly intervals to look at water quality, and to investigate what the major water sources and sinks are.

Paul Racey, Cilla Racey and Martin Stanley returned again during November/December 2005, during which time they enjoyed a day of hydrological sampling and game spotting. A successful second annual workshop was held during their visit to give an update to the various stakeholders, and identify future directions and collaborations.

As for the future, we will be forging links with various research establishments in Zambia, to try and encourage higher levels of undergraduate research and teaching within the national park. A group of students from Glasgow University in the UK also hopes to visit the park for 6-8 weeks during August and September 2006 to undertake baseline monitoring projects within various freshwater habitats (which will be a great help to the Darwin project), and to get involved with education projects in local community schools.

Finally, we are also currently interviewing for a Zambian graduate assistant, following the placement of a series of national adverts. The response to the adverts was good and we hope to appoint an assistant before Christmas.

Mike Kennedy (Darwin Researcher), December 2005.

Paul Reyhing water sampling on the Mulembo River.

A sequence from miombo woodland edge, through termitaria grassland and seasonally inundated grassland in a dambo – the kind of habitats that will be central to the burning research

Appendix 5

Darwin Initiative: biodiversity and water research in and around Kasanka National Park

People living close to the main entrance of the Kasanka National Park (KNP), or walking nearby along the main Tuta road may have noticed a white Land Rover parked up from time to time next to the Chitikilo, Njelele, Mpulumba or Mulembo streams, and groups of people drawing buckets of water, taking samples, and using various pieces of equipment. People may, quite rightly, wonder what is going on. This monitoring represents just part of a project based at the Kasanka Research Centre, on the edge of the park, entitled 'Conservation of Wetlands and Associated Biodiversity in Northern Zambia'. The project is funded under the UK government Darwin Initiative programme, which is aimed at conserving biodiversity and increasing awareness of conservation issues in developing countries through research and education. The initiative began following the Earth Summit held in Rio de Janeiro, Brazil, in 1992. This is the first Darwin Initiative to be based in Zambia and is administered through the University of Aberdeen in the UK.

Project activities began in 2004 with the training of Kasanka Scouts in conservation issues, but the main research thrust began in August 2005 with the Arrival of myself as researcher. Lackson Chama also joined the team in January 2006. He is a native Zambian with experience in both natural resources and development issues, and has previously spent time as a volunteer in the park in 2005.

The main emphasis of our project is to investigate the sources and sinks of water in the parkand it's wider catchments, and to investigate interactions between seasonality of burning, water quality and habitat utilisation by large grazers in some of the key habitat types. Every fortnight visits are made to around thirty different sites, including lakes, rivers and boreholes, in and around the park. Sampling allows us to assess water quality and give us an idea of where water is being stored and where it's flowing. We have also set up trial plots around a complex of enclosed dambo's in the park. Trials will contrast early burning, late burning, and absence of burning, in wetland and surrounding miombo habitats, and the consequences for vegetation development, grazer distribution and soil conservation.

We have also been setting up other monitoring schemes within including intensive studies of soil moisturedynamics within a dambo system, the installation of rain gauges at new sites, and hydrological monitoring of the floodplain swamp areas. Monitoring will soon begin in the wet evergreen Mushitu woodland where the famous Straw-Coloured fruitbats roost seasonally. The aim of all this data collection is to allow future management of key habitats in and around the park to be carried out with a greater degree of scientific understanding, and to help limit changes to these habitats and their animal populations due to human or natural activities.

We wish to actively involve local schools and other groups in our work, and one idea of is to involve schools in the national tree-planting day on December 15th (more on this in a future edition). We will also be trying to track down additional funding to undertake projects such as intensive hydrological monitoring during the 2006/7 rainy season and behavioural studies of the rare Sitatunga antelope (after all, Kasanka is probably one of the best places in the world to see this beautiful animal). In the meantime we are looking forward to a visit this August by students from the university of Glasgow in the UK. The students will be based at the Kasanka Research Centre for six weeks and are keen to get involved with both environmental, and community-based education projects.

Further information about the Darwin project can be found on the Kasanka website (www.kasanka.com), and about the Darwin Initiative in general on www.darwin.gov.uk. Further details are also available from the Darwin office at the Kasanka Research Centre.

On a final note, I have been struck by the friendliness of the Zambian people and the interest shown in the project. If you see us in out sampling in future then please do come and talk to us if you're curious…

Dr. Mike Kennedy

Habitat types within Kasanka National Park (KNP)

1. Key Habitat Types

Kasanka National Park (KNP) is important in national and international terms for the variety of habitats it contains (see www.kasanka.com), and the range of animals that are supported within these key habitats (a number of these species being rare or threatened).

1.1 Freshwater Habitats

Freshwater habitats are central to the character and ecological integrity of the park. These freshwater habitats include:

- **Papyrus swamps**: Support resident and migratory birds, and rare antelope species such as Sitatunga (*Tregelaphus spekei*). These swamp habitats are relatively extensive within the park, and also provide attractive viewing areas for visitors.
- **Lakes:** Both perennial and seasonal lakes and open water bodies (including sink-hole lakes) are present within the park. These open water habitats, along with a number of the rivers in the park, provide habitat for Hippopotamus (*H. amphibious*), and both Nile Crocodile (*Crocodylus niloticus*) and Slender snouted Crocodile (*Crocodylus spp.*). Areas of fringing emergent vegetation are important for insects such as dragonfly, plus species of wading birds and Sitatunga.
- **Perennial Rivers** (e.g. the Musola stream, the Kasanka River and the Luwombwa River): These rivers are currently undamed (both within and outside of the park) and represent naturally functioning systems which support a range of fish, bird and other species. Under high flow conditions during the rainy season, the rivers maintain connectivity with backwaters, thus replenishing water levels and nutrients. Such backwaters often function as good areas for fish spawning.
- **Dambos:** These seasonally inundated wet grasslands, which are essentially extensive drainage channels support species such as Waterbuck (*Kobus ellipsiprymnus*) and Reedbuck (*Redunca arundinum*), and various wading birds.
- **Riverine Floodplains:** These seasonally inundated habitats provide good grazing habitats (often in association with drier grassy scrub and woodland) for antelope species such as Sable (*Hippotragus niger*) and Puku (*Kobus varonii*).

1.2 Woodland habitats

A variety of woodland types are found within the park.

- **Miombo (or Brachystegia) woodland:** Covers the largest area of the park and supports species such as Roan antelope (*H. equines*) and Sable Antelope (*H. niger*), Lichenstein's Hartebeest (*Sigmoceros lichensteinii*), Warthog

(*Phacochoerus aethiopicus*), Bush pig (*Potamochoerus porcus*), Common Duiker (*Sylvicapra grimmia*) and Yellow Baboon (*Papio cynocephalus*).

- **'Mushitu wet evergreen forest:** This is a woodland habitat which is underpinned and maintained by the freshwater inputs into the park. The largest patch of mushitu forest provides a roosting area for an annual influx from other countries in Southern Africa of Straw-coloured fruitbats (*Eidolon helvum*). The population estimates for the annual influx of bats is around 8 million, and the bats are reliant upon revering fruiting tree species such as Waterberry (*Syzygium guineense*). This mushitu forest borders the largest area of papyrus swamp, Kapabi swamp, and are therefore likely to be maintained by both surface water and groundwater inputs.
- **Mateshe woodland:** These remnant habitats of dry evergreen forest are found on deeper and more organically rich soils than the more widespread miombo woodland. They are generally found along river corridors and are not widespread in the park, but represent unique assemblages of tree species. They are therefore important in terms of overall biodiversity support.
- **Chipya woodland:** This woodland type is also present in the park, generally on deeper soils. The woodland is characterised by non-miombo (i.e. generally fire-resistant) tree species, a relatively open canopy, and distinctive field layer containing relict evergreen species such as Pteridium *aquilinum* and *Aframomum alboviolaceum*. The Chipya woodlands are thought to perhaps occur as a result of the burning of Mateshe woodland.

2. Potential Threats to habitat stability

The flagship habitats which require careful conservation within Kasanka National Park can probably be regarded as:

- **Mushitu** (wet evergreen) woodland.
- **Papyrus swamp.**
- **Dambos** (seasonally inundated)
- **Lakes, Rivers** and other open water habitat and associated **wetland** habitats.

Threats to these habitats might be in the form of:

- **Hydrological change**: Both water quality and water quantity is important in maintaining the main freshwater habitats. Initial results of water sampling undertaken in the National Park (as part of a UK government Darwin Initiative funded programme aiming to aid conservation of the main freshwater wetland habitat) suggest that that water quality is currently very good across the park, and that enrichment of waterbodies is from natural geological weathering and incursion of

water though deep geological deposits as groundwater. There is also good evidence to suggest that several of the rivers in the park are maintained, at least partially by groundwater inputs.

As the wider catchment for the park lies outside the park boundaries (e.g. extending towards the Congo Basin), external activities might have a detrimental impact on the freshwater habitats of the park. These include:

(i) Increased abstraction from surface water or groundwater resources which might lead to reduced water levels in the wetland habitats,

(ii) Damping down of natural flow patterns and seasonal flood regimes by the introduction of dams upstream of the national park. This will also potentially reduce seasonal inputs of nutrient rich sediments to backwaters and floodplains under flood conditions,

(iii) Increased nutrient loading (e.g. nitrate and phosphate) from artificial fertilizer application upstream, leading to eutrophication of water bodies. This may come in the short term from surface flow, while the permeable geology might also lead to pollution of groundwater deposits (potentially leading to long term inputs of excess nutrients into freshwater habitats within the park.

(iv) Clearance of primary and secondary woodland outside of the park, potentially leading to increased soil and silt input into river systems.

(v) Increased illegal hunting and burning activity within the park, which might have an impact (by way of peat fires for example) on key habitat types such as the mushitu woodland during the dry season.

Dr Michael Kennedy

Darwin Researcher

c/o Kasanka National Park