DARWIN INITIATIVE FOR THE PROTECTION OF SPECIES
Annual Project Report Form

Project Details

Project Title   Terrestrial Invertebrate Diversity of the Mkomazi Game Reserve, Tanzania.

Institution   Natural Resources Institute

Round 1   ☑   (please tick)

       2   ☑

       3   ☐

Project Objectives

a) Please state the objectives of the project

1. To conduct a baseline inventory of selected terrestrial invertebrate groups for the MGR by making representative taxonomic collections and identifying these where possible to genus and/or species.

2. To provide quantitative measures of the species numbers and diversity of key invertebrate groups for the major habitat types within the MGR, including calculation of appropriate indices of diversity.

3. To measure the degree of change in species diversity (β) and faunal similarity between major habitat types within the MGR.

4. To determine the effects of burning and grazing on species richness and diversity in different habitat types.

5. To develop secure, well-documented savanna invertebrate biodiversity collections at the TPRI, Arusha, Tanzania.

6. To provide training for Tanzanian personnel in:
   - collection and preparation of biological material for diversity studies,
   - maintenance of biodiversity reference collections,
   - taxonomy of appropriate invertebrate groups, and
   - measurement and interpretation of ecological parameters including diversity indices.

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b) Outline progress towards the achievement of each objective over the last year. Explain any problems/difficulties which have been encountered to date in achieving the objectives of the project (or any which you envisage may be encountered in the future).

Objective

1.　　　During 1995/96 three field visits to Mkomazi G.R. were undertaken by UK staff, totalling 13 man-weeks. During these visits further sampling of Coleoptera (Davies), arachnids (Russell-Smith) and canopy invertebrates (McGavin) was undertaken using, pitfall traps, sweep netting, Malaise traps, insecticide fogging and hand collecting. Up to April 1995 over 500 morpho-species of Coleoptera and over 300 morpho-species of spiders have been identified from the reserve. Insecticide fogging of invertebrates from 183 trees belonging to 29 species has revealed densities of invertebrates in the range 500 - 2,500 m^{-2} , figures which are 5 to 10-fold greater than those recorded from the canopies of tropical rain forests.

2.　　　Analysis of data for species richness and species diversity of ground-active Coleoptera and spiders has been undertaken for two sampling occasions in 8 distinct habitat types within the reserve. Results will be reported fully elsewhere but suggests that diversity is affected both by woody plant cover and by soil moisture availability. Difficulties in achieving both this and the previous objective have been experience due to the time required to sort the large number of species represented in pitfall traps and the insecticide fogging samples.

3.　　　No progress was made on this objective during 1995/96 because measuring β diversity requires a complete data set for each individual habitat type. This will not be available until 1996/97.

4.　　　The effect of burning on richness and diversity of ground-active beetles and spiders in *Acacia/Commiphora* bushland and in mixed footslope grassland were calculated from pitfall trap catches on two sampling occasions (Nov. 1994 and April 1995). In both habitats, burning did not appear to have any consistent effect on species richness or diversity indices of either group. In part this may be attributed to the short (9 day) period of trapping on each occasion and to the fact that pitfall traps measure activity rather than population densities. There may also be large seasonal changes in activity of these groups which affect the results. In order to isolate such seasonal effects on diversity, a series of regular monthly pitfall trap samples in these habitats was initiated in April 1995 and will continue until March 1996. Sorting of the material from these samples has recently been initiated.

5.　　　Two entomological cabinets for storage of insects collected by the project were shipped to TPRI, Arusha and received in good condition. Sorting and identification of insects continues and transfer of duplicate collections to Tanzania is expected late 1996.

6.　　　a) Two Tanzanian technicians from TPRI have been trained in a wide range of insect collection techniques appropriate for biodiversity assessment in the field. This training has been put to good use as the same technicians have now undertaken regular monthly pitfall trapping for surface-active invertebrates in four habitats in the reserve and have completed initial sorting of the material.

　　　　b) Mr Bruno Nyundo (University of Dar-es-Salaam) attended the IIE course in insect identification in July and August 1995 where he obtained a thorough grounding in the basic taxonomy of all insect orders. At the same time he visited Oxford University and established useful working contacts with Dr George McGavin and Dr Graham Stone, both involved in the Mkomazi Project.

　　　　c) In November 1995, Mr Nyundo started the MSc course in Systematics & Biodiversity at the University of Wales in Cardiff. Mr Nyundo has now completed the taught part of the course and obtained over 90% in his practical examination. He will be undertaking a project on the systematics of Diptera from Mkomazi under the joint supervision of Dr Mark Jervis (Cardiff) and Dr Graham Stone (Oxford) and is due to complete the course in July 1996.

Project implementation timetable

a) Outline progress over the last year against the agreed baseline timetable for the project. If some milestones have not been achieved or have slipped, explain reasons for this.

There was an initial delay in appointing a Darwin Scholar for training in the UK owing to the difficult of finding a suitably qualified candidate. This has now been overcome by offering a one year rather than two year training course. Other than this the timetable to date has been achieved. However, it is envisaged that there may be slippage in achievement of certain objectives, particularly production of refereed papers, due to the time required for sorting and identification of the rich and diverse invertebrate samples collected. This applies particularly to studies on the invertebrate diversity of tree canopies sampling of which has already produced an estimated 0.5 million specimens.

b) If the baseline timetable has slipped or changed, provide an updated project implementation timetable for the remainder of the project. (Please note this will have to be passed to the DoE for approval.)

Given the anticipated slippage mentioned in a) above it is suggested that Milestone 8 "Completion of at least three scientific papers by March 1997" be modified to "Completion of at least one scientific paper by March 1997 and at least two further scientific papers by September 1997".

c) What is the estimated completion date for the project ?

31 March 1997

d) Is this different to the completion date set out n the original application form

Yes   ☐   (please tick)

No   ☐

Project Outputs

a) What outputs have been achieved by the project over the last year ? We would like you to work through the list of standard outputs attached to this form and to report on those which are relevant to your project. All information provided should be referenced clearly to the appropriate project output reference number. (Any further outputs which do not fall into the standard output categories should be reported at the end of this section).

Output Ref. No.	Description/Commentary
Training outputs	
2 a & b	By 31 March 1996, one Tanzanian student will have received 4 months post-graduate training on the University of Wales MSc in systematics and biodiversity. He is expected to complete the course by July 1996.
4 a & b	One Tanzanian technician attended the IIE course in Insect Systematics in July and August 1995 and was awarded a diploma.
5 a & b	Two technicians from TPRI, Tanzania received training in the field on methods of sampling invertebrates for biodiversity surveys. This included 13 man weeks working alongside UK staff when they received instruction in the use of pitfall trapping, sweep net sampling, malaise trapping, insecticide fogging and hand collection.
Research outputs	
8	UK project staff spent 13 weeks on project work in Tanzania up to 20 March 1996. One staff member will spend a further 3 weeks in Mkomazi from 21 March 1996.
12.	A report on the results from the first year of the project (1994/95) was produced and included in the annual report for the wider Mkomazi Ecological Research Project, published by the RGS in July 1996.

b) Explain any problems encountered to date in achieving the outputs set out in the original application form or any problems you envisage in achieving these outputs in the future.

It is envisaged that there may be problems with the production of refereed papers by the completion date of the project due to the time required for sorting and identification of the rich and diverse invertebrate samples collected. This applies particularly to studies on the invertebrate diversity of tree canopies sampling of which has already produced an estimated 0.5 million specimens. Likewise the large volume of pitfall trap material (over 12,000 trapping days) will generate a very large workload in sorting and identifying the material collected.

Staff Resources

a) Please provide details on the key staff who have worked on the project over the last year

Name	Institution	Grade/Position	Input during 1995/96
Dr M. Ritchie	Natural Resources Institute	Grade 7	1 man month
Dr A. Russell-Smith	Natural Resources Institute	Grade 7	1 man month
Dr G. McGavin	Oxford University Museum	Assistant keeper	1 man month
Mr J. Davies	Natural History Museum	Short term contract	1 man month

b) Please explain any variation in the composition of the project team or in the inputs of key staff from the details provided in the original application form.

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Publicity

Explain what has been done to publicise the project during 1995/96.

A newsletter covering the work of the wider Mkomazi Ecological Research Project was published and a section included on the invertebrate diversity work funded by the Darwin Initiative. The newsletter was distributed widely both in Tanzania and in the UK.

Currently the Duke of Kent, as patron of the RGS, is visiting the Mkomazi Ecological Research Programme. A member of the Darwin team, Dr G. McGavin, will be present during the visit and will explain the work of the Darwin project to the duke and his party.

An article on the work of the Darwin project has been prepared by the press officer for the RGS and will appear in the Times newspaper science section in the very near future.

Narrative Statement

a) Please provide a summary of work undertaken over the last year (including details on scientific research being undertaken, if relevant).

1. Scientific research

Research in 1995/96, addressing objectives 1 to 4, has focused primarily on continuing sampling, sorting and identification to develop a baseline inventory of the target invertebrate taxa and on preliminary analysis of data on the effects of burning on invertebrate diversity in grassland and *Acacia/Commiphora* bushland.

A total of over 500 morpho-species of beetles have been identified from the reserve up to April of 1995. Greatest species richness of terrestrial beetles has been recorded from unburned footslope grassland and unburned *Acacia/Commiphora* bushland at Ibaya. Species numbers in burnt grassland and burnt bushland were 14 % and 24% lower than in the equivalent unburned sites. However, Margalef diversity indices for burnt and unburned habitats were similar except for the *Acacia/Commiphora* bushland in November 1994 when there was a 12% reduction in diversity in the burnt site. Eight other habitats have been sampled using pitfall traps but at a lower intensity than the Ibaya sites. Among these, *Combretum* and *Dichrostachys cinerea* scrub at Dindira had the highest species numbers and diversity indices (probably equivalent to those at Ibaya allowing for the lower sampling intensity) while riverine bush and *Commiphora* scrub on the Umba river in the East of the reserve had the lowest, possibly due to the low and highly erratic rainfall in this part of the reserve.

Over 300 morpho-species of spiders and some 20 morpho-species of other arachnids (scorpions, solifugids, opilionids etc.) have been identified from the reserve by April 1995, probably the richest area for arachnids so far described from Africa. As with the beetles, the greatest numbers of species have been recorded from grassland and *Acacia/Commiphora* bushland at Ibaya. There was no reduction in numbers and diversity of spiders in burnt as compared to unburned grassland but a 20% reduction in both numbers and diversity in the burnt as compared to unburned bushland in November 1994. In all samples taken, three families, Salticidae, Gnaphosidae and Zodariidae dominate species numbers. Other diverse families include Oxyopidae, Lycosidae and Oonopidae among ground-active species and Thomisidae, Araneidae and Theridiidae in the grass and tree layers. The fauna of a dry forest at the summit of Ibaya hill is particularly distinctive, with between 70% and 80% of species not recorded from other parts of the reserve.

Insecticide fogging samples from the canopies of trees have been taken from 183 individual trees of 29 species. Special attention has been paid to *Acacia* and *Commiphora* species, the dominant genera in the reserve. To date, an estimated half a million invertebrate specimens have been collected. Densities of invertebrates from trees for which figures are available range from 500 to over 2,500 m^{-2}. These figures are between 5 and 10-fold greater than equivalent published figures for invertebrate densities from tropical rain forest canopies. Because of the large numbers of specimens involved, only a part of the samples have been sorted to families and it is not yet possible to report on species diversity from individual trees. The dominant phytophagous arthropods include Coleoptera, Hemiptera (particularly Cicadellidae), Phasmatodea and Thysanoptera. Dominant carnivores are ants, spiders, Mantidae and Reduviidae.

2. Training

During this period two TPRI technicians have received on the job training in methods of sampling for assessment of invertebrate diversity and on basic invertebrate taxonomy. This included 13 man weeks working alongside UK staff when they received instruction in the use of pitfall trapping, sweep net sampling, malaise trapping, insecticide fogging and hand collection.

Mr Bruno Nyundo (University of Dar-es-Salaam) completed the IIE course in insect identification in July and August 1995 where he obtained a thorough grounding in the basic taxonomy of all insects orders. At the same time he visited Oxford University and established useful working contacts with Dr George McGavin and Dr Graham Stone, both involved in the Mkomazi Project.

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b) What are the main problems/difficulties which the project has encountered over the last year ? Are there any lessons to be learnt ?

The principle difficulty encountered is that caused by the large quantities of invertebrate specimens obtained from this extremely diverse semi-arid area of Tanzania. As a consequence, the time required for sorting and identification of the material obtained was severely under-estimated in the original project proposal. This will inevitably have an impact on the production of scientific outputs from the project and a suggestion for re-phasing of this work has been put forward in this report.

Where a Darwin project includes invertebrate biodiversity assessment, which can generate very large samples (in the range 10^4 to 10^6) it would perhaps be wise to establish a project timetable only after preliminary sampling has established the size and diversity of the invertebrate fauna of the target area. This could be done by establishing an indicative timetable and list of outputs in the project application, with a mandatory revision of the timetable at the end of the first year of fieldwork.

c) Finally, are there issues you wish to raise with the Department (for example, on management /monitoring/financial procedures or on any other matters) ?