CENTRE FOR ECOLOGY AND HYDROLOGY - MONKS WOOD

NATURAL ENVIRONMENT RESEARCH COUNCIL

DEPARTMENT OF BIOLOGICAL SCIENCES, FOURAH BAY COLLEGE

UNIVERSITY OF SIERRA LEONE

Habitat Audit and Change Detection in Sierra Leone

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CEH PROJECT No: *C02009*

CONTRACT NO: *11-006*

Darwin Initiative for the Survival of Species

Annual Report

1. Project Information

Project title	*Habitat Audit and Change Detection in Sierra Leone*
Country(ies)	*Sierra Leone*
Contractor	*Centre for Ecology and Hydrology*
Project Reference No.	*11-006*
Grant Value	*£60,211*
Start/Finishing dates	*April 2002 to April 2004*
Reporting period	*April 2002 to April 2003*

2. Project Background

Sierra Leone is emerging from 10 years of civil war. During the war somewhere between a third and a half of the rural population were displaced, this has greatly disturbed land use patterns with impacts on land cover and biodiversity. The magnitude of the changes is unknown. It is our contention that Sierra Leone can not meet its obligations under the Biodiversity Convention unless it has some idea of what biodiversity resources it still has. We believe that the ability to produce good quality maps of land cover, land cover change and habitats are a prerequisite to understanding what has happened and is happening to the natural environment in Sierra Leone. Advances in software (for remote sensing and geographic information systems) in hardware (global positioning systems, digital cameras, laptop computers) and reductions in the price of data mean that mapping land cover should now be within the capability of Sierra Leone and it should not have to rely on the whims of outside agencies for habitat mapping.

3. Project Objectives

The purpose of the project is defined in the Logical Framework (Appendix 1) as "Transfer skills and technology necessary to produce reliable maps of habitats and change in habitats from multi-spectral and SAR imagery".

The objectives and activities have not changed, however, their relative importance and time expanded on them has been rebalanced. The change in emphasis occurred as a result of consultations with the stakeholders before and during the start-up workshop. These issues have not (yet) been discussed with the Darwin Secretariat as communication between Sierra Leone and the UK were even more problematic than anticipated. Stakeholders were able to tell us about a handful of Sierra Leonians who were at one time or another trained overseas (USA, the Netherlands and Nigeria) in these technologies (geographic information systems, global positioning systems, remote sensing). However, on their return to Sierra Leone they operated as isolated workers and organizational, financial and technical problems meant that their skills

were rarely exploited for long and quickly decayed. Stakeholders believe that is needed is to try and develop the Department of Biological Science into the national focal centre for GIS & RS so that there was a self sustaining "critical mass" of researchers using the techniques (as well perhaps in sharing data costs, providing safe backup facilities, loan of equipment and mutual support activities).

The project proposal included plans to study Gola Forest, however, it was discovered that the forest falls on the boundary of 4 scenes and the total budget for the project was only for 3 scenes at two dates. It was, therefore, decided that it would be more beneficial for the project to initially obtain Landsat scene 201/54 which is the only scene entirely within the country. A contributing factor in the decision was the difficulty in finding good quality cloud free images for that part of Sierra Leone. UNAMSIL (United Nations Mission to Sierra Leone) have complete Landsat coverage of Sierra Leone we have met with them and it looks promising that we can help each other (although we have to be a little careful about copyright restrictions on the data).

4. Progress

UK partner taught at Fourah Bay College from 18th November 2002 to 17th February 2003, 30 days paid for by DI the remainder paid for by accumulated annual leave. Trainees from the university were very high calibre, trainees from the ministries and NGO's were fully acceptable. Training in the use of the optical data (Landsat 5 & 7) went very well; many types of land cover changes could be easily and reliably identified. Use of the radar data was a hampered by lack of ancillary data, however I have arranged for a UK based research student to try and sort some of those problems out before the second visit.

Due to change in emphasis suggested / required by stakeholders the number of trainees and the number of test sites were substantially increased, from two trainees to seven and from one test site to five. Case studies to be used in future training / teaching (second field season and post DI project) are now being developed:

- Deforestation of Fourah Bay Botanic Reserve,
- Impact of beach sand extraction on coastal erosion,
- Condition assessment of the Western Area Forest,
- Habitat mapping in the Outamba-Kilimi National Park,
- Use and abandonment of inland valley swamps in central Sierra Leone.

Progress with: obtaining data and hardware, identifying candidates, holding a workshop, establishing a base of operation and performing hard and soft classification of one or more test sites occurred on or before their planned date.

Progress with producing the school packs has been delayed by the discovery that the Conservation Society of Sierra Leone already produces teaching material (student and teachers work books) for both primary and secondary schools. We are discussing how best to collaborate with that activity. Progress with the publicity pack for journalists was over taken by the fact the project had already been reported in the local press (who picked it up from the article on the Sierra Leone news web), and because UK partner was interviewed on SLBS for both national radio and as a special edition of the economics programme (half hour) on television in the second week before anything formal could be prepared.

Progress with using the radar data has been slow, I have arranged for a research student to try and sort out the problems before the next field visit. The British National Space Centre are preparing (may already have submitted?) a mega-bid to the EU proposing to use almost exactly the same techniques we proposed for this project, with luck we may be able to collaborate.

Trainees were selected from the University and Conservation Society on personal recommendation of partners. Trainees from the Ministries were nominated by the Minister (or his deputy). In all cases trainees were computer literate and had relevant interests. The original plan was to have fewer trainees for which I was planning on performing a simple "brain dump", however, with more trainees I was needed to develop an "introductory" set of notes (about 14 pages without figures). Both hard (lmaximum likelihood) and soft (lBaysian) classification techniques were taught, emphasis was on "hard" techniques as they are most commonly used. Because of the inherent "fuzziness" of boundaries and in definitions (eg what constitutes a forest) soft classifiers may be more appropriate in some circumstances. Field work concentrated on areas within the Freetown Peninsular, although visits to the centre and north of the country were undertaken.

Non-payment of advance to collaborators in Sierra Leone meant that UK partner had to pay for the start-up workshop out of his own funds. Non-payment also created difficulties with regards to transport and providing training allowances for the trainees. However, these problems were overcome without any detrimental effect on the project.

The exit strategy now includes a bid to the British Council to establish an HEI LINK (in collaboration with Prof. Andrew Millington of Leicester University). If successful this will provide funds to exchange staff between the UK and Sierra Leone for short visits over the period 2004 to 2010 (3 years plus 3 years extension).

A time table for future activities follows.

May-November 2003 - develop case studies into teaching materials (in consultation with Leicester University). Sort out problems with radar data. Provide "distance learning" support.

November2003-february 2004 - second training period activities as originally planned, plus extra trainees and biomass assessment carried over from year 1.

5. Partnerships

Collaboration with the host country went very smoothly and was very productive. The inability of CEH accounts to transfer the agreed advance to the partners was obviously embarrassing but did not damage the project. There are no difficulties or unforeseen problems with the partners.

We established a link with a local NGO the 'Environmental Foundation for Africa' and intend to submit a proposal to introduce the technique of propagating trees from cuttings. Many tropical trees are difficult to propagate from seeds, CEH Edinburgh has considerable experience with vegetative propagation in the tropics, but the technique appears to be completely unknown in Sierra Leone. The proposed project has two aims: one is to preserve the genetic resource of the Botanic Reserve by propagating trees in a safe location until such time as the area can be protected (or a new area found). The other aim is to provide native trees for dissemination to existing village woodlot schemes, the EFA have several years experience of such schemes, but every scheme relies on non-native species - even those organised by the Forestry Department.

We established a link with UNAMSIL to try and pool mapping resources. They have complete cover of Landsat data and also selected coverage from IKONOS which we could use for validation data. Their staff know nothing but military applications of GIS and RS and seem keen to broaden their horizons.

(Not strictly a biodiversity project), one the lecturers in the Department has promised to try and find some Honours students this year to do their thesis project on composting. Hopefully there will be three students studying the technical, financial and social implications. If it looks feasible we will try for funding from DFID for a pilot project starting on the university campus. At the moment the campus has no solid waste disposal system - rubbish is thrown onto middens and occasionally burnt, this is unhealthy, unpleasant and wasteful. Poorer parts of Freetown are in a very bad state.

6. Impact and Sustainability

The project has appeared on the Internet (on the main news web page for the country), in the local press, with the local partner we gave an 8 minute interview on national radio and the UK partner gave a half hour "special" for the weekly economics programme on the television.

We are discussing with the Conservation Society how to collaborate on "public understanding of science" issues given their experience in producing teaching materials for the local schools. There are many charities and aid agencies active in Freetown at the moment; almost all involved in short term "sticking plaster" approaches to poverty, their activities make it difficult for our project which is much more concerned with long term strategic management to be noticed.

We consulted with all the stakeholders we had identified before the project started and then found several more once the project started. Both the Government Ministers we meet (Dr. S.S.Monde - Agriculture and A.B.Sesay - Lands and the Environment) and the Presidents Chief Scientific Advisor were supportive of the project as were the Vice Chancellor of the University and Principal of the College. The stakeholder workshop was lively and well attended.

The exit strategy has been strengthened by the bid to the British Council for an HEI LINK.

7. Outputs, Outcomes and Dissemination

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

Code No.	Quantity	Description
6c	7	Includes 2 lecturers, 1 part time lecturer / member of Conservation Society, 1university technician, Senior assistant conservator of Forests, 1 ministry of lands, 1 Rokuppr Rice Research Institute.
6d	10	Not more than 2 at one time, 2 weeks each not necessarily consecutively.
7	6	Course notes plus case studies
8	12	Half paid by DI, half "annual leave"
10	0	Guide to habitat classification

11A	1	Paper on fate of Botanic Reserve almost ready for submission to Biological Conservation
11B	1	Article for NERC publication Planet Earth accepted.
12B	1	Provided advice and training on using Access to university technician working in the Herbarium
14B	3	Seminars for Cambridge Conservation Forum, CEH and University of Leicester.
15B	1	Picked up from Internet.
18A	1	8 minute interview
19A	1	Half hour special on weekly economics programme

Changes

6c/6d - People trained were more senior than anticipated (planned on training post graduates that is 4's not 6's).

7 - training material for non-trainees changed (see above).

10 - guide delayed by problems with using radar data. Can't get the biomass estimates at the moment and still trying to find out whether the stock estimates that could be used for validation still exists.

11A - output early.

11B, 12B, 14B, 15B, 18A, 19A - unanticipated outputs.

Table 2: Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (e.g. contact address, website)	Cost £
Periodical (Planet Earth)	Mapping in the tropics, R.A.Wadsworth 2003	Natural Environment Research Council, Swindon	NERC www.nerc.ac.uk	0

Dissemination primarily through increased number of trainees, visits to stakeholders and workshop.

By training lecturers at the Department we should be able to make the techniques a standard part of courses in the Biological Sciences.

If the bid to the British Council is successful then it could help disseminate the results of the project.

8. Project Expenditure

Table 3: Project expenditure during the reporting period

Item	Budget	Expenditure

Major variations

a) Change in emphasis in project (at behest of stakeholders) this now represents training allowances rather than full salary replacement

b) Reduced amount of field work because of extra time in classroom

c) GPS (much) cheaper than anticipated and only one purchased in first year (rather than 2) because of doubts over whether such a cheap GPS would be suitable (it was).

d) We managed to persuade the European Space Agency that we should be a "CAT-1" user and therefore they could supply us radar data at a reduced cost.

9. Monitoring, Evaluation and Lessons

Evaluation of this year's activities will be done by three factors:

How many e-mail messages I get requesting help with the technology (although a low number might mean everything went very well or very badly) (so far only one).

How much field data / ground data the trainees collect between now and November for their own projects / interests (two projects known to be on-going).

How much the trainees appear to remember when I return.

I whole-heartedly welcome the introduction of pre-project funding to help define exactly what is needed. This project was developed without any face to face contact between the partners, or with much contact of any sort with the stakeholders, while it was a good proposal it could have been better if we had just a little funding before hand.

10. Author(s) / Date

Richard Wadsworth / 23rd April 2003

Appendix 1 - Logical Framework

Project summary	*Measurable indicators*	*Means of verification*	*Important assumptions*
Goal			
To assist countries rich in biodiversity but poor in resources with the conservation of biological diversity and implementation of the Biodiversity Convention		Use of better data within the National Environment Action Plan and by Conservation minded organisations within and outside Sierra Leone.	Better information leads to better decisions.
Purpose			
Transfer skills and technology necessary to produce reliable maps of habitats and change in habitats from multi-spectral and SAR imagery.	Ability of staff in the Department of Biology and Government Departments to generate maps of land cover and quantify change.	Quantitative assessment of products. Qualitative assessment of performance. Take up of product and process by NGOs and Government.	Can find suitable candidates to train Technology and approach will work. Government and NGOs accept new approach
Outputs			
A group of researchers capable of carrying out similar mapping exercises in other parts of the country and in the future as reconstruction commences.	Example maps of habitats for three selected areas Example maps of changes in habitats in the three areas 1991 to 2001.	Ground truth verification. Uptake of maps and expertise by stakeholder community. Extension of work methods to other areas.	Methodology works and produces an output that is "fit for purpose"..
Activities			
University identifies suitable trainees Stakeholders identify critical habitats "hard" and "soft" classification of multi-spectral data. Biomass estimates (SAR) Texture analysis (SAR) Combination of all data Verify/ validate. Dissemination	trainees found report from first workshop map map map map and report on validation. exercise. Response to competitions, number of newspaper reports	trainees turn up. report circulated to stakeholder community, Cambridge Conservation Forum etc. maps validated maps validated maps validated maps validated validation possible Quality of response to competitions, quality of reports in local papers. Combination "adds value" maps "fit for purpose" Can produce meaningfull approach.	suitable trainees exist agreement can be reached suitable imagery exists (Dec-Feb period) Biomass distinguishes "farm bush" before sensor saturates. Texture distinguishes primary from secondary forests Combination "adds value" Maps "fit for purpose" Can produce meaningful approach