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## **DARWIN INITIATIVE: Madagascar Wetlands Project**

**DETR Project Ref. No 162/07/113**

### **FINAL REPORT**

#### **1. Basic Project Details**

**Project Title:** Madagascar Wetlands Project

**Contractor:** Royal Holloway Institute for Environmental Research, University of London

**Host country collaborating institute(s):** Ministère des Eaux et Forêts (Direction Générale), and Centre National de Recherche sur l'Environnement, Madagascar

**Grant Round:** 6

**Grant Value:** £62,699

#### **2. Project Expenditure**

**Total grant expenditure:** £62,699

**Breakdown of expenditure (using expenditure categories in the original application form)**

**Explain any variations in expenditure +/- 10%**

	1998/99 spend	1999/2000 spend	Total spend
Rents			
Postage, tel., stationery			
Travel and Subsistence			
Printing			
Conferences and seminars			
Capital items			
Salaries			
Total			

#### **3. Project Background/Rationale**

**Why was the project needed? Please explain the project development process.**

Important progress in wetland conservation in Madagascar has been made in the last five years, in part through the country's involvement with the Convention on Biological Diversity (CBD) and Convention on Wetlands (Ramsar Convention). Under the latter convention, two sites have been designated for inclusion in a List of Wetlands of International Importance

(Ramsar Sites). Two more sites were considered, and one of these—Lac Sahaka—was rejected because of a lack of data on its current importance; it was known to have been very important in the past. To address the lack of information, and specifically to allow a decision to be made whether to designate Lac Sahaka as a Ramsar site, in October 1997 the Ministère des Eaux et Forêts (Direction Générale, DGEF) identified a multi-disciplinary environmental study of Lac Sahaka as an urgent priority for the programme of activities to meet Madagascar's obligations under the Ramsar Convention and CBD. The co-ordinator of tropical projects at RHIER visited Madagascar in 1997, and the DGEF immediately requested that RHIER should carry out this study. A proposal to the Darwin Initiative was written immediately after this visit, and approved for initiation in 1998. The Centre National de Recherche sur l'Environnement, a Malagasy institution, later joined the project as a partner with special interest in sustainable development, and specific expertise in wetland hydrology and soil.

#### **How was it related to conservation priorities in the host country?**

Madagascar supports rich, extraordinary and highly threatened biodiversity. Wetlands are widespread there, even occurring in the most arid areas, and from the humid coastline to the marshes of the high mountain domain. However, no inventory of Madagascar's wetlands has been compiled. In addition, despite the breadth of environmental activities in recent years, limited resources have not allowed all environmental management priorities to be addressed, and wetlands, both freshwater and marine, have had very limited attention. This has been agreed in all major 'prioritising' exercises in recent years. Conservation to maintain the natural functioning of wetlands, often by retaining some patterns of local use, can ensure continued delivery of the multiple benefits that these ecosystems bring. The need to work specifically at Lac Sahaka was identified by the DGEF for the reasons described above.

#### **How was the project intended to assist the host country to meet its obligations under the Biodiversity Convention?**

Wetlands are one of the priorities in Madagascar's National Environmental Action Plan, a 15-year process, the initiation of which pre-dated the CBD but which has become the main framework for the CBD's implementation. All three central tenets of the CBD were addressed by the project: conservation (identifying, prioritising and promoting the importance of sites with high biodiversity); sustainable use (identifying direct and indirect values, both goods and services, that arise from wetland biodiversity) and equitable sharing of benefits (identifying stakeholders and promoting management methods for their benefit).

#### **Was there a clear 'end-user' for the project in the host country? Who?**

The Ministère des Eaux et Forêts (Direction Générale) needed the information in order to decide on designation of Sahaka as a Ramsar site, and the local staff of the Ministry needed the information to guide management which is their responsibility. Two additional applications and another end-user also emerged when the project began:

- the DGEF requested that information be gathered on the importance of a Hunting Reserve (Réserve de Chasse) established in 1969 at Sahaka, because the possibility existed that the Réserve boundaries could be revised.
- information on the biodiversity and physical geography was needed to support a new (1998) regional conservation and development initiative in the Lac Sahaka–Daraina region, which is of high biogeographical interest, implemented by a Malagasy non-governmental organisation, Fanamby.

## 4. Project Objectives

### What were the objectives of the project (as stated in the original application form)?

The overall goal of the project was to promote the sustainable management of wetland biodiversity in Madagascar, through demonstration of the full range of benefits brought by this biodiversity at a demonstration site. This goal will be pursued through the following objectives.

- 1) Investigate the biodiversity and other important values (such as coastal protection and hydrological controls) of Lac Sahaka, a highly seasonal lake in north-east Madagascar, around the year.
- 2) Document traditional management methods used by local people at Lac Sahaka, and assess the status and likely future changes in the ecosystem, through participatory rural appraisal with long-term inhabitants and discussion with managers.
- 3) Use UK expertise in wetland biodiversity and functioning to train Malagasy scientists in assessment of these values.
- 4) Identify and promote sustainable activities and benefits, as justifications for 'wise use', the ratification of the Ramsar Convention, and implementation of the Convention on Biological Diversity by the Government of Madagascar.

### Were the objectives of the project revised?

No.

### Have the objectives (or revised objectives) been achieved? If so, how?

Objective 1 (biodiversity and other important values at Lac Sahaka) was achieved by:

- review of literature concerning the region
- discussion with local people and officials regarding direct uses
- three visits to Lac Sahaka by teams of UK and Malagasy staff, and two by Malagasy staff only, to study wetland distribution and classification, ecology (especially vegetation and birds; also mammals, reptiles and fish), hydrology (water levels, water budget, water quality and climate), soil and socio-economics.

Objective 2 (traditional management methods, and likely future changes in the ecosystem) was achieved by:

- three village workshops (open meetings), attended by up to 150 villagers
- discussions with:
  - a) local staff of the Ministère des Eaux et Forêts
  - b) local government: mayor, deputy-mayor, and local district leaders
  - c) head of the 'Zone d'Animation Pédagogique' (leading teacher for the region);
  - d) the president of the local forest committee
- interviews with elders of the longest-established villages in the area
- discussion with local staff of the non-governmental organisation *Fanamby*.

Objective 3 (train Malagasy scientists) was achieved by:

- working alongside Malagasy counterparts in all fieldwork activities
- testing, through unsupervised visits to the study site and also to a nearby, never-surveyed wetland area, assessed by reports produced after the visits

- collaborative writing of preliminary reports or newsletters

Objective 4 (identify justifications for 'wise use', and implementation of the Ramsar Convention and CBD by the Government of Madagascar) was achieved by:

- attendance by Safford at National Ramsar Committee meeting and workshop, including a presentation on results at Lac Sahaka and facilitation of discussion on activity under the Ramsar Convention;
- production of a simple, educational poster in Malagasy on 'The Values of Wetlands';
- sponsorship of attendance by the head of the Biodiversity Conservation Service at DGEF (Mme Fleurette Andriantsilavo) at the Ramsar CoP and Global Biodiversity Forum in 1999;
- establishment of an 'Accord Cadre de Collaboration' between RHIER, Direction Générale des Eaux et Forêts and Centre National de Recherche sur l'Environnement, to foster further wetland research in Madagascar.

**If relevant, what objectives have not been achieved, or only partially achieved, and why?**

All objectives have been achieved.

## 5. Project Outputs

**What output targets, if any, were specified for the project? (Please refer to the project schedule agreed with the Department where relevant.) Have these been achieved? If relevant, what outputs were not achieved, or only partially achieved, and why? Were any additional outputs achieved? If output targets were not specified, please state the outputs achieved by the project. As far as possible, we would like you to work through the list of outputs attached to this paper and to report on those which are relevant to your project.**

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Ref. no    Output target and output achieved

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### TRAINING OUTPUTS

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**4C/D**    Target: four Malagasy staff, total of 60 person-weeks  
 Achieved: eight Malagasy staff, total of 53 person-weeks

Training provided through participation in field research and report-writing in ecology (F. Razafindrajao, 10 weeks ecology, 2 weeks hydrology; E. Tidahy, 4 weeks, soil survey; J. Ralaimaro, 8 weeks, hydrology; Vincent de Paul, 3 weeks, hydrology)

V.S. Rakotonirina and V. Andriatsalama (Ministère des Eaux et Forêts) joined fieldwork for one week each to see the project's model for multidisciplinary wetland work.

G. Razamany and M. Sola (local leader) worked with us full-time during field trips and gained experience in wetland survey work (12 weeks each).

After UK staff visit, Sola accompanied Razafindrajao for further survey work, highly successful, without trainers.

**7**    Target: one poster  
 One poster on Values of Wetlands completed (1000 copies) and circulated

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**RESEARCH OUTPUTS**

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- 8 **Target: 30 man-weeks**  
**25** man-weeks spent by UK staff (R. Safford and A. Hooijer) in host country. AH missed the last trip because of departure from RHIER, his duties were carried out by RS, or by AH in UK before leaving.
- 9 **Target: one plan**  
**One** comprehensive report with management recommendations published
- 13A/B **Target: none specified**  
**One** collection of wetland plant species handed over to herbarium of Parc Botanique et Zoologique de Tsimbazaza, Antananarivo (March 1999) and later enhanced (August 1999). **one**

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**DISSEMINATION OUTPUTS**

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- 14A **Target: three workshops**  
**Three** workshops held. First, one in each of the two 'Fokontany' (local administrative district) that include part of the lake; attended by 75 and 150 people. Then, final forum on management of the lake area with leaders of local stakeholder groups, attended by 25 people.
- 14B **Target: four workshops**  
**Four** workshops attended: Ramsar CoP and Global Biodiversity Forum (international) and National Ramsar Committee (2 workshops) to present findings
- 14C **Target: none specified**  
**One** seminar: Safford was invited to National Ramsar Committee seminar/meeting; presented report on Sahaka with view to listing as Ramsar Site, and also gave advice on continuing promotion of wetland management strategy under Ramsar and Biodiversity Conventions.
- 16A **Target: one newsletter**  
**Three** newsletters produced in English and French; November 1998, March 1999, August 1999. First was put on to the project web-site in English and French, and contents of second one added by integrating into a single text; the third newsletter was also added to web-site as it stood.
- 16B **Target: none specified, but 16B+C: 50 copies**  
Hard copies: **c.30** in host country; unknown additional number through World-Wide Web.
- 16C **Target: none specified, but 16B+C: 50 copies**  
Hard copies: c.10 in UK; most circulation through **World-Wide Web**. Circular publicising www version was sent to **80** organisations internationally, and then publicised on list-servers such as Ramsar Forum; circulation probably in hundreds.
- 17A **Target: none specified**  
**One** dissemination network—Madagascar wetlands working group—enhanced and extended

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**PHYSICAL OUTPUTS**

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20 

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**FINANCIAL OUTPUTS**

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23 

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Agreed in proposal:

- RHIER [REDACTED] for salaries on project
- Ramsar Convention [REDACTED] for poster
- IUCN [REDACTED] Commission on Ecosystem Management costs

Raised in project:

- GB£ [REDACTED] (approx.) salary costs of Malagasy counterparts paid by their institutions.
  - GB£ [REDACTED] from DFID small grants scheme to support Fanamby (Malagasy NGO) sustainable development work **applying project results**
  - GB£ [REDACTED] from a range of trusts and societies to support survey of bats at Lac Sahaka by University of Glasgow post-doctoral researcher M. Cottam as part of Darwin project.
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The following is an additional output:

**Accord Cadre de Collaboration** set up between RHIER, Direction Générale des Eaux et Forêts and Centre National de Recherche sur l'Environnement. This is a valid output as it is in force for 5 years and will foster further wetland research in Madagascar; these accords are difficult to get.

## 6. Project Operation/Management

**Research projects - please provide a full account of the scientific work undertaken, outlining the methodology adopted, the staff employed and the research findings. The extent to which research findings have been subject to peer review should be addressed.**

Research was concentrated in three main areas, described below in turn.

### HYDROLOGY AND SOIL

#### *Methods*

The only data pertinent to hydrology available before the study were 1950 aerial photographs, a 1:100,000 map of the area, and rainfall data for Vohemar and other stations in the region.

The flooding extent was mapped during the dry season (November 1998), wet season (March 1999) and climatically intermediate period (August 1999), by foot surveys using maps and a Global Positioning System. Water depths were measured during boat surveys. Water quality in most parts of the wetland was measured in November 1998 and March 1999. Because of the obvious importance of evaporation and consequent concentration of solutes, parameters measured were pH, conductivity, chloride and calcium.

Information based only on **relatively short visits** by the project team was valid but inadequate because of the **rapid changes** that were reported by villagers. We therefore worked with **villagers to allow them to collect simple rainfall and water level data on a daily basis**. We supplemented this with our own observations during the study visits. Water levels were monitored from November 1998 to November 1999 at four points in the Lac Sahaka system. Gauges of 2.5 to 3.5 m height above the level of the lake bottom were constructed using local wood and construction materials, and local villagers were recruited and trained to perform daily measurements and maintenance.

The system worked perfectly, verified by three independent cross-checks. At the end of the year, levels were corrected, to make them comparable. Once a 'zero' was set, the water

table could be used as a horizontal reference level to construct topographic maps from water depths (bathymetry). Water flow velocity and direction at the four points was monitored visually and noted as none (approximately  $< 0.05\text{ms}^{-1}$ ), slow ( $0.05\text{--}0.2\text{ms}^{-1}$ ) or fast ( $>0.2\text{ms}^{-1}$ ).

A simple soil survey was carried out to assess suitability of soils for agriculture, with standard soil survey and analysis methods.

### Results

The wetland was divided into three main basins— South, North and Agnengo (in the far north)—and four satellite areas. They are connected to two rivers: the Antsahampano which feeds the lake starting with the South Basin, and the Manambato, into which the lake drains when levels are very high. Five stages were distinguished in the hydrological cycle, based largely on flow conditions and hydrological connectivity: drying, filling, normal wet season, high water and extreme events. Extreme fluctuations were found in water chemistry, with concentration of salts occurring in the dry season.

The geomorphology and hydrology of Lac Sahaka make it extremely susceptible to environmental change if these properties are altered even in small degrees. The closeness of average annual rainfall (1230 mm) and potential evapotranspiration (1313 mm), means that the balance between these two quantities could easily be altered. The consequences of hydrological alteration of Lac Sahaka could, at worst, be drastic. Direct evidence for this sensitivity was provided by the strong fluctuation of water quality according to water level. If annual actual evapotranspiration in a wetland equals annual inputs (from rainfall, runoff and groundwater), water would be removed but solutes would not, and so salts would accumulate. Permanent increases in solute concentrations may occur; this is known as salinisation – the process of becoming a salt-lake.

Several development options which might seem tempting from an economic perspective involve reducing freshwater inputs or enhancing evapotranspiration outputs, and so could jeopardise water quality and in the long term reduce agricultural productivity and biodiversity. These include large-scale groundwater abstractions, dams combined with large-scale irrigation of higher agricultural grounds, extensive dike systems within Lac Sahaka to create a 'padi' rice growing system with extended periods of standing water, and dams to hold water for agricultural use for longer periods. These findings were incorporated into the final report and management recommendations.

The pedological survey revealed three main soil types: eolian, alluvial and organic (hydromorphic) soils. The eolian soils are of relatively little interest to management as they are mainly sand, neither cultivated nor occupied by wetland. Alluvial soils were deposited on low-lying plains subject to frequent inundation. Two samples analysed had organic matter contents of 4-6 %, nitrogen content of 0.2 % and a clay texture with pseudogley due to temporary or permanent waterlogging, and were rich in exchangeable bases. They were considered highly suitable for agriculture. Organic soils were found in flooding basins. In four samples analysed, organic matter contents were 20-30 %, and C/N ratios were 26-30; assimilable Phosphorus was deficient, at less than 0.01 %. However, much variation was seen in the organic matter contents in areas not sampled, and a wider-ranging study is needed assess the true variation.

### Staff and peer review

Field-work was led by A. Hooijer (RHIER), working with J. Ralaimaro and V. de Paul (hydrologists at the Centre National de Recherche sur l'Environnement, Madagascar), and Edmée Tidahy (independent Malagasy consultant soil scientist, attached to Bureau d'Etudes Savaivo). Specialist advice was received from A. Joignerez and L. Robison (hydrologists working in Madagascar), Dr J. R. Thompson (hydrologist at University College London, on

villager-led monitoring schemes and Afrotropical floodplain hydrology), and Dr N. Rakotondranaly (pedologist, Bureau d'Etudes Savaivo).

## BIODIVERSITY

### *Methods*

During each visit, the **main plant communities** were tentatively identified by determination of the dominant plant species or in some cases families. The characteristic wetland species were collected and preserved using the dry press method. Notes were kept on the distribution of the genera *Eichhornia*, *Salvinia* and *Pistia*, as they contain species that are often invasive in freshwater ecosystems.

**Water-bird species** were identified by direct observation and vocalisations. At each season, every part of the three main basins of Lac Sahaka was visited, along with as many as possible of the marshes and lakes in the surrounding area. Geographical coverage was almost complete, because of the limited extent of the wetland, and the accessibility by canoe or on foot of all parts of it. **Long-term changes** were assessed by comparing our data with those from the **only previous surveyor** (A. L. Rand, in 1930), and also from interviews with the **local elders** who had detailed knowledge of local wildlife. Birds of wetland areas were compared using the following four measures: (1) total species richness; (2) similarity between site pairs (Sorensen's Index); (3) maximum bird population; (4) number of threatened or restricted range species, or of species represented by large congregations. Threatened species are those listed as globally threatened or near-threatened in the latest Red List, restricted range species have world areas of occupancy less than 50,000 km<sup>2</sup>, and large congregations are those comprising 1% or more of the regional population.

**Other fauna surveyed** were mammals (including bats), reptiles and fish. All were identified from specimens and photographs.

### *Results*

The wetland vegetation of Lac Sahaka showed characters often considered typical of both eastern and western Madagascar, when examined at species or community level. **Endemicity was very low**, but the degree of division of habitat gradients among species ( $\beta$ -diversity) was high, based on the proximity of numerous plant communities with dissimilar floras. **Infestation** by Water Hyacinth *Eichhornia crassipes* was severe over most of the wetland, with **several adverse impacts noted**.

The bird community of Lac Sahaka is diverse, fairly abundant and more typical of western than of eastern Madagascar. It is certainly **unique in northern Madagascar**. Waterbird species richness and populations at Sahaka are exceeded only by a few sites in western Madagascar, such as Lacs Bemamba and Ihotry and various coastal areas. The species for which Sahaka is of special interest include three threatened species, two species of restricted range and large congregations of four species. It has already been classified as an **Important Bird Area**, based on records of four wetland bird species and it is now shown to qualify on the basis of **four more**. Threatened mammals and reptiles also use the site, although species richness is low, as always in Malagasy wetlands.

### *Staff and peer review*

Biodiversity surveying was led by R. Safford (RHIER), and carried out mainly with F. Razafindrajao (Malagasy counterpart). M. Cottam and M. Heath (zoology volunteers from the University of Glasgow) carried out a short survey of bats (unfortunately cut short by family illness). Plant specimens were identified by Dr Hery Lisy Tiana Andrianasetra Ranarijaona (leading aquatic botanist in Madagascar) and checked also with the herbarium staff of the Parc Botanique et Zoologique de Tsimbazaza (Madagascar's national herbarium). For birds, the two observers (the authors) were both familiar with nearly all of the



bird species expected, having carried out wetland bird surveys elsewhere in Madagascar; data were checked and discussed with BirdLife International (Projet ZICOMA) staff including Dr F. Hawkins. Other fauna were identified by or discussed with Drs D. M. Meyers (lemurs), K.J. Riseng and J. Sparks (fish), A. Cooke (turtles), J. Russ and Prof. P. A. Racey (bats); all are leading authorities on their taxa in Madagascar.

## SOCIO-ECONOMICS

### *Methods*

A Malagasy non-governmental organisation, Fanamby, in co-operation with the local staff of the Ministère des Eaux et Forêts, began conservation work in the region in 1998, around the same time as the Darwin project began. At the outset, the Darwin project and Fanamby therefore co-ordinated work programmes, and worked together in the field. During the period of the Darwin project, information gathering by Fanamby was focused entirely on socio-economics, producing a detailed profile of the area's stakeholders and their activities, and developing a network of contacts at regional and village level through which to introduce new land management methods.

The Darwin project therefore concentrated on the physical geography (especially the hydrology and geomorphology) and biodiversity of Lac Sahaka. Stakeholder assessment was focused on the significance of changes in the wetland's functions to local people, which were not addressed by Fanamby. This information was compiled from personal observation by the authors, and the following sources:

- Ministère des Eaux et Forêts: Chef de Triage Daraina
- Commune and local district leaders, other respected figures such as the pastor, president of the Forest Committee, teachers
- two open meetings;
- one forum for elders and respected figures invited by the local leaders.

This list is believed to be a comprehensive set of stakeholder representatives in the Sahaka region.

### *Results*

Local opinion was unanimous that very great changes have occurred in the last 50 years in Lac Sahaka and its catchment. Overall, life has become harder. The main changes have been:

- abandonment of rice cultivation upstream of the lake,
- establishment of rice cultivation in the lake,
- change in the fishery caused by fish introductions,
- change in the vegetation caused by Water Hyacinth,
- increase in human population, and
- decline in wildlife.

Before these changes occurred, the lake was used for fishing (using traps rather than nets), grazing zebu and hunting for food. Few people lived close to the lake. The main preoccupation of the local population is now over the continuing availability of, and their stewardship over, the natural resources necessary for rice cultivation, with fish and water supply additional key issues. These are the main resources that have declined or changed greatly over the lifetimes of the elder residents.

### *Staff and peer review*

Relations with local communities were managed by R. Safford (RHIER), F. Razafindrajaio (project Malagasy counterpart), M. Sola (district leader) and G. Razamany (president of local Forest Committee). Advice on wetland conservation issues in general was received from Aristide Andrianarimisa and Rivo Rabarisoa (Peregrine Fund, Madagascar), Joanna Durbin,

Richard Lewis and Lala Jean Rakotoniaina (Durrell Wildlife Conservation Trust, Madagascar). Local staff of Fanamby joined us in the field and at workshops, giving further guidance on local information sources and relations with outsiders.

**Training projects - please provide a full account of the training provided. This should cover the content of the training, arrangements for selecting trainees, accreditation, etc.**

No formal training was provided; rather, participants learnt by carrying out the research described above in collaboration with the UK staff.

#### *Wetlands poster*

This was an educational activity more than true training, but is described here. The concept arose from the realisation that wetland values were being widely ignored in Madagascar, either through the common assumption that conversion was the best management option, or the belief (rejected by many Malagasy) that the existence of rare, endemic species was the only reason to conserve them. A poster, in Malagasy language, showing the wider values of wetlands to people as well as to wildlife, was agreed to be a much-needed activity, as a practical, accessible demonstration of some of the concepts underlying the CBD 'ecosystem approach'.

It was decided that a painting by a Malagasy artist was best. A suitable artist, J. Rakotonindrina, was found, and designs agreed with R. Safford. Captions were prepared in English and translated by the outreach specialist at Durrell Wildlife Conservation Trust, who also advised on the appropriate way to convey the message of the poster, as did the Malagasy attaché at the Madagascar Consulate in London. The painting and captions were sent to UK, and prepared and printed (1000 copies) by Elisabeth Cossons, an English graphic designer, before being sent back to Madagascar.

#### **Did any issues or difficulties arise in running and managing this project?**

- For project co-ordination, communication with counterparts in Antananarivo is slow because of exceptionally poor telecommunications in Madagascar, especially in government organisations (NGOs are often better equipped). For example, it is often impossible to phone, fax or email the Ministère des Eaux et Forêts. Foreign organisations trying to operate without a permanent office in Madagascar will have great difficulty, unless they have a very helpful facilitating organisation (as this project did, in the form of the Durrell Wildlife Conservation Trust). Dealing with organisations outside Antananarivo was especially difficult; the artist for the painting (resident in another city) usually took weeks or months to contact, and local communities around our study site were effectively uncontactable.
- The main problem with field-work was local villagers' suspicion of foreigners; they are always friendly, but often correct information on local uses and attitudes can be very hard to obtain. Working through local leaders is the solution.

## 7. Project Impact

**To what extent has the project assisted the host country to meet its obligations under the Biodiversity Convention, or to what extent is it likely to do so in the future?**

Much overlap exists in the scope of the CBD and Ramsar Conventions, and this is formally recognised in a Memorandum of Co-operation between the Bureau of the Ramsar Convention and the CBD Secretariat, covering among others co-ordination of work programmes (a joint Ramsar-CBD work programme was later approved), and encouragement of integration and consistency between activities under the two conventions. Therefore, we treat activities under the two conventions together.

- Attendance of Mme Fleurette Andriantsilavo at the Ramsar CoP and Global Biodiversity Forum (GBF13) in 1999, sponsored entirely by the Darwin project, had several benefits. Government capacity in support of CBD and Ramsar Conventions was enhanced by her experience. By the same action, the project provided direct input to the CBD, through Mme Fleurette's presentation at GBF13 at the workshop on *Indigenous Peoples and Local Communities' Participation in Wetland Management*. She was the only Malagasy to make a presentation at any of the GBF13 workshops. Links between Madagascar, the CBD secretariat, Ramsar Bureau and other contracting parties were thus improved. Mme Fleurette was not the only Malagasy delegate to attend these events, but she was arguably the most effective participant, and would not have attended without the Darwin project's involvement.
- Madagascar state membership of IUCN. Immediately after the Ramsar CoP and Global Biodiversity Forum in 1999, Madagascar, a lapsed member, rejoined IUCN. We believe that the Darwin Project contributed to this, by encouraging contact with IUCN staff, through RHIER's links with Wetlands Programme and Commission on Ecosystem Management. State membership of IUCN will bring many benefits to Madagascar in its efforts to meet obligations under the CBD.
- The project contributed to a rebirth of the National Ramsar Committee. The meeting at output 14C (March 1999) was important because the project helped to catalyse it. The committee had not met since October 1997. It was organised by the DGEF to coincide with the Darwin project staff's passage through Antananarivo, because (1) the Darwin project was designed specifically to assist Madagascar with Ramsar and CBD obligations, and (2) the DGEF wants to list Lac Sahaka as a Ramsar Site. At the meeting, Safford gave a presentation on the results at Lac Sahaka, and these were discussed among participants. In addition, information on the Darwin Initiative, CBD and Ramsar Convention, including new and important contacts, were presented by Safford.

**Describe the way in which research findings have been used to address biodiversity objectives. What actions have been taken, or are expected to be taken, as a result of the project? How will these contribute towards the conservation of biodiversity in the host country concerned?**

The research findings of the environmental and biodiversity study at Lac Sahaka have been used to address biodiversity objectives according to the 'ecosystem approach', which is the primary framework for action under the Convention on Biological Diversity, and the 'wise use' principle under the Ramsar Convention. Such an approach acknowledges and is built around the three central tenets of the CBD: conservation, sustainable use and equitable sharing of benefits.

Three specific applications for the information have been identified. At present, most are recommendations which will require time to implement at government level; however, recommendations to NGOs are being implemented already.

*Is Lac Sahaka suitable for listing as Ramsar site? (requested by DGEF and the National Ramsar Committee)*

The study found that it would be highly suitable, and recommended that the site be designated. This has now been proposed by the National Ramsar Committee, following the project/Ramsar National Committee workshop in March 1999.

*Should changes be made to the boundary of the Lac Sahaka Hunting Reserve? (requested by DGEF)*

The study found that the existing site of the reserve (covering a small proportion of the wetland) is not optimal for biodiversity conservation, and causes resentment locally because access to resources is barred. We recommended an alternative site, but we emphasised that maintaining a small, strict protected area was not a full solution, and that this should be an element of a wider ecosystem management strategy.

*What recommendations can be made for the design of conservation and development activities in the Daraina region to ensure that wetland benefits are optimised and biodiversity is conserved (requested by DGEF and the NGO Fanamby)?*

A series of recommendations was made concerning the scope of planning, key areas for biodiversity, zonation, water resource management, managing invasive species and environmental monitoring. Some of these, such as the scope of planning (extended to include the satellite wetlands) have already been adopted by Fanamby.

**Describe the extent to which training provision has improved the capacity of the host country to conserve biodiversity in the future, and the extent to which the training has addressed real skill needs. Information should be provided on what each student/trainee is now doing (or what they expect to be doing in the longer term), and the extent to which their skills are being used in a positive way to promote biodiversity conservation in the host country.**

The most important trainee was Felix Razafindraja, who completed his university degree (equivalent) during the study. Before the study, he was working on short-term contracts with the Durrell Wildlife Conservation Trust (DWCT) studying waterbirds, closely supervised and lacking responsibility. In the Darwin project, he learnt the following skills:

- visiting study sites alone (on two occasions at Lac Sahaka) with responsibility to check on progress of hydrological monitoring and relations with villagers
- reporting, budgeting and accounting for such fieldwork
- basic hydrological monitoring, which he has already put into practice at another site in western Madagascar
- further skills in identifying and counting waterbirds
- leading a short survey of a biologically unknown site—the Baie de Lokia (around 50 km from Sahaka)—together with one of the village leaders (Matthieu Sola) from Sahaka. This visit was highly successful—good information on the site was obtained, and new populations of three threatened species were found.

He is now one of the leading Malagasy wetland conservation field-workers, still with DWCT, and has succeeded in introducing hydrology into their wetland conservation projects, which was previously lacking.

Hydrologists **Joseph Ralaimaro** and **Vincent de Paul** were trained in three main ways:

- establishing and maintaining villager-led hydrological monitoring schemes, and analysing and interpreting data from such schemes.
- planning integrated wetland field-work projects, which was rarely carried out before by any organisation;
- enjoying participation in wetland field-work in remote areas; for example, they volunteered to use the project boat unsupervised to check details relevant to hydrology at remote parts of the site.

Both remain at the Centre National de Recherche sur l'Environnement.

**Government officials Voahirana Andriatsalama** and **Victor Solo Rakotonirina** also saw (and participated in) for the first time an integrated study of a wetland, taking in biodiversity, hydrology and socio-economics. They both commented that such a model would be very valuable for other wetland sites in Madagascar. Both remain with the Ministère des Eaux et Forêts.

**Edmée Tidahy** (soil scientist) was trained in soil survey methods, and (a more important contribution of the project) in integrating soil survey work into multidisciplinary wetland study to help management planning. Helped by a reference from the Darwin Project, she is now working as a soil scientist on a land management project on the high plateau of Madagascar.

By participating in all activities in the programme, **Matthieu Sola** and **Georges Razamany**, local village leaders, gained experience in the approaches and methods used to assess and manage wetlands. Sola co-ordinated the hydrological monitoring programme throughout the year, and accompanied F. Razafindrajaon on the visit to the Baie de Lokia. The knowledge they gained will allow them to take a more active part in stakeholder discussions about the future of Lac Sahaka, and also to assist with environmental monitoring programmes recommended by the project.

**Describe the wider impacts of the project in terms of the level of collaboration achieved between UK and host country institutions, and the prospects for greater joint working/information exchange in the future. To what extent has good collaboration been achieved?**

Collaboration has been very good. This is confirmed by:

- the DGEF's enthusiasm to sign an Accord Cadre de Collaboration with RHIER in force for 5 years and covering further wetland research in Madagascar
- the Centre National de Recherche sur l'Environnement wishing to be included in the accord
- DGEF's willingness to send additional staff to the Ramsar CoP and GBF under the project's auspices, and to send two HQ staff to the field-work site

The project has helped to strengthen UK involvement in Madagascar in general. The Darwin Initiative was much admired and appreciated by government officials in both the Ministère de l'Environnement and the Ministère des Eaux et Forêts.

## 8. Sustainability

**Did the host country institute(s) contribute resources to this project (these may have been provided in-kind, for example staff, materials etc)? If so, what is the monetary value of the resources committed to the project by the host country institute(s)?**

- [REDACTED] (approx.) salary costs for both Malagasy partners providing staff for project activities, including field-work and attendance at Ramsar CoP and GBF [REDACTED]
- The Centre National de Recherche sur l'Environnement (CNRE) provided hydrological equipment (current meters) worth around [REDACTED]
- CNRE provided extensive meteorological data, which would normally cost [REDACTED] from the Service Météorologique.

**To what extent was Darwin funding a catalyst for attracting resources (including in-kind contributions) from other sources? Please provide details on the other sources from which resources were secured for this project. What is the monetary value of resources generated for the project from other sources (please provide an estimate for each funding source)?**

A total of [REDACTED] worth of additional resources was generated by the project, either to boost project activities or to finance activities catalysed by the project.

- Approx. GB£ [REDACTED] from DFID small grants scheme to support Fanamby (Malagasy NGO) sustainable development work applying project results
- GB£ [REDACTED] from a range of trusts and societies to support survey of bats at Lac Sahaka by University of Glasgow post-doctoral researcher M. Cottam as part of Darwin project. Full list: British Ecological Society, Percy Sladen Memorial Trust, Glasgow Natural History Society, Scottish Royal Zoological Society, Whitley Wildlife Trust, William Dickerson Travel Fund and The Frederick Soddy Trust.
- RHIER [REDACTED] for salaries on project
- Ramsar Convention [REDACTED]
- IUCN [REDACTED] Commission on Ecosystem Management costs

**To what extent is work begun by the project likely to be continued in the future (if this is relevant - some projects may come to a natural end at completion)? This is more likely to be relevant for research-based projects.**

- The project provided the necessary information to allow **recommendations** to be made on the future of Lac Sahaka, and management activities around Sahaka can proceed, with government and NGO support (Fanamby, which has close links with Conservation International, which regards the Daraina region as a priority area).
- The improved capacity to meet obligations under the CBD and Ramsar Conventions will continue to be used, to **designate Ramsar Sites**, and to implement policies of wise use and the ecosystem approach.
- The educational **poster** on Values of Wetlands is being disseminated widely in Madagascar to encourage wider regard for these values.

**Has the project acted as a catalyst for other projects/initiatives in the host country? Is it likely to do so in the future?**

1. A strong contribution was made by the project in demonstrating and promoting to other institutions the **value of integrated approaches** and methods to assess and manage wetlands. Arguably, conservation in Madagascar is overly dominated by purely biological

science, which may neglect the true (physical, social or economic) nature of the threats and limiting factors. One international NGO commented that ours was "the first project to use hydrology for conservation". Another consulted Darwin project staff in great detail about hydrological and geomorphic classification of wetlands (which are widely accepted as more rigorous than ecological classifications).

2. During the project meetings and the National Ramsar Committee workshop, national priorities for wetland conservation and management were discussed. A national wetland inventory was identified as one of the highest priorities, and it is very likely that such a project will follow. RHIER hopes to be involved.

3. The NGO Fanamby, working in the Daraina–Sahaka area, decided to include Sahaka in its project area, which it was not certain of doing before the Darwin project results were provided.

4. Some of the impacts mentioned under question 7 were initiatives catalysed by the Darwin project:

- contribution to restoring Madagascar's state membership of IUCN
- contribution to 'rebirth' of the National Ramsar Committee
- signing by DGEF of Accord Cadre de Collaboration with RHIER, for 5 years and covering further wetland research in Madagascar

## 9. Outcomes in the Absence of Darwin Funding

**Had Darwin funding been unavailable for the project, what would have been the most likely outcome?**

The project would probably not have proceeded, as other institutions were not expanding their wetland programmes into the region.

**Had this project not been undertaken, how would the users/beneficiaries of the project have met their requirements? Would other organisations/initiatives have been able to meet their needs (at least to some extent)?**

The conservation and development project in the area would have proceeded without any wetland biodiversity inventory and without a hydrological assessment. This could have had severe consequences, because of the sensitivity of the lake system to changes. Examples of such consequences include the following:

- the villagers had requested that dams be built to hold more water in the lake, and the relevant NGO staff told us that this could have been agreed to if the Darwin project had not shown that the likely results would be complete drying of downstream areas and possibly salinisation of upstream areas. This would have been disastrous.
- the key areas for wetland biodiversity were not known; many were 'satellite wetlands' (small wetlands around the periphery of the Sahaka area) which had not been included in plans by the conservation and development project.

## 10. Key Points

### What would you identify as the key success factors of this project?

- Good collaboration with DGEF, through shared ideas and project development process in which their views were actively sought
- Good prior knowledge of working conditions and contacts in Madagascar by the project leader
- Helpful facilitating NGOs (not partners) such as Durrell Wildlife Conservation Trust
- Interdisciplinary approach, involving physical, chemical, hydrological and socio-economic understanding alongside biology; hydrology was especially important.
- Sensitivity to local feelings and working conditions
- Extensive scientific network for correspondence and planning

### What were the main problems/difficulties encountered by the project?

- Difficulty of communication with counterparts in Antananarivo, and near impossibility of dealing with organisations outside Antananarivo.
- Local villagers' suspicion of foreigners
- Dominance of biological science in conservation work, resulting in difficulty in explaining need for (e.g.) hydrological studies. This was in practice more of an annoyance than a hindrance to this project, but organising multi-partner projects in future may find this a bigger problem.

**What are the key lessons to be drawn from the experience of this project? Please try to provide as much information on this point as you can so that others can learn from the experiences of your project.**

#### *Project start dates*

The project began in October, which allowed a comfortable lead-in after the grant announcement was made. Starting in April, the earliest opportunity, would have been difficult. Could grant announcements be made any earlier to make starting in April easier, especially for packed three-year projects with no time to lose?

#### *Project lengths*

For a varied and entirely new initiative, efficient working relationships and *modus operandi* with partners typically takes around two years to develop. In this case, the leader's experience in Madagascar (even though this was based on work before going to Royal Holloway Institute for Environmental Research) compensated, so that work began efficiently and immediately. However, we might have been more successful in catalysing new initiatives, and raising additional resources, if we had made this a three-year (not two-year) project, because experience (e.g. the Darwin Melaleuca Wetlands Project, 1995-98, Darwin round three) suggests that many such results are achieved in the third year.

#### *Collaboration*

The DGEF were highly appreciative of the project development process in which the (prospective) project leader visited them to ask them what their priorities were. This made for very good relationships, easy permissions, and enthusiasm to agree a 5-year collaborative 'Accord' with RHIER.

#### *Input to the CBD: the role of Global Biodiversity Fora*

- The Global Biodiversity Forum (GBF) workshops that precede SBSTTA meetings or CBD/Ramsar COPs provide an excellent opportunity to feed Darwin project results and



activities into the CBD process, and to increase national capacity to implement the CBD. We used this mechanism in both our previous Darwin Melaleuca Wetlands Project and the present Madagascar Wetlands Project.

- Alternatively, Darwin project results presented in country (especially if to the CBD CoP/SBSTTA country delegates and national report writing team) might influence resolutions proposed. The country might see fit to propose something new as a result, or might be prompted to amend resolutions proposed by another country. This points back to knowing how the CBD works in the host country: at the start of the project, one could consult with the CBD focal point on ways to filter lessons from the project into the CBD process.

These points were made in a letter from Roger Safford to Valerie Richardson in May 1999, but are repeated here as experience last year has strengthened the view.

**Does the experience of this project imply a need to review arrangements for developing and managing projects funded as part of this Initiative? No**

## **11. Project Contacts**

**To assist future evaluation work, please provide contact details (name, current address, tel./fax number, e-mail address), for the following:**

**UK project leader (and other key UK staff involved in the project)**  
Roger Safford

[REDACTED]

Hydrologist: was at RHIER until October 1999.  
Al Hooijer

[REDACTED]

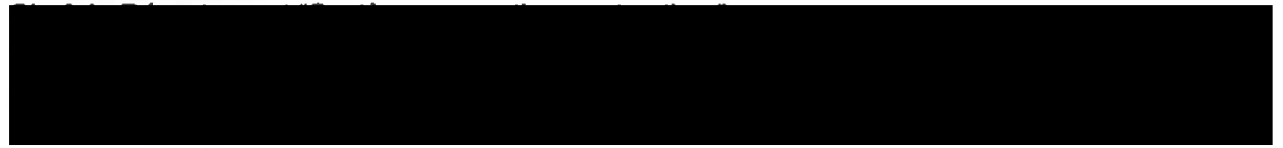
**Host country project leader/co-ordinator (and other key people involved in the project at the host country collaborating institute)**

Mme Fleurette Andriantsilavo

[REDACTED]

Other contacts at Ministère des Eaux et Forêts (same address)  
Mlle Voahirana Andriatsalama, Chef de Division Flore et Faune  
M. Vincent Hilarion Razafimandimby, Secrétaire Général des Eaux et Forêts

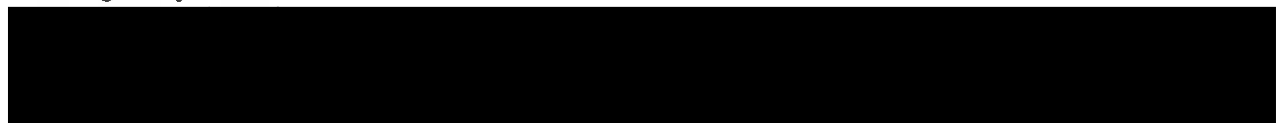
Dr Laurent Robison



**'End users' for the output produced by the project in the host country (i.e. government departments, agencies, universities, local communities etc)**

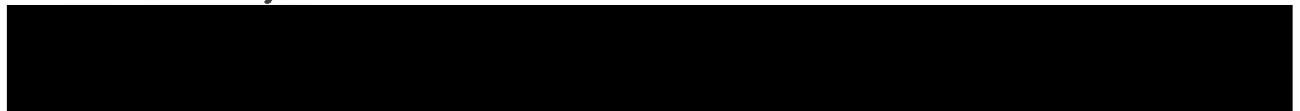
Mme Fleurette Andriantsilavo  
Chef du Service de la Conservation de la Biodiversité  
MINISTÈRE DES EAUX ET FORÊTS (address above)

M. Serge Rajaobelina

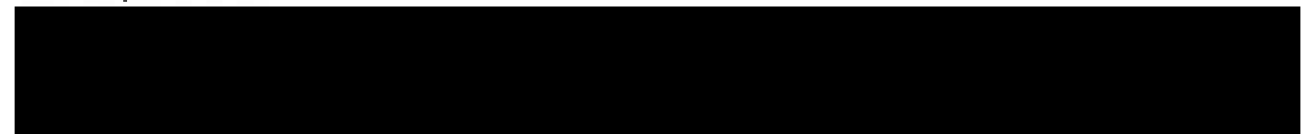


Project trainees/students

M. Felix Razafindrajao



M. Joseph Ralaimaro



**Other project beneficiaries**

M. Matthieu Sola



**Other key players involved in the funding/operation/utilisation of the project**

Mr Anada Tiéga



M. Odon Rakotonomenjanahary and Dr Frank Hawkins



Dr Joanna Durbin



### **Documentation attached**

- Poster on values of Wetlands (A2 size) under separate cover
- Accord de Collaboration with Ministère des Eaux et Forêts and Centre National de Recherche sur l'Environnement
- *An environmental and ecological study of Lac Sahaka, Madagascar*. Final report, English version (improved, French version will be produced by August 2000)
- Printout of web-site (English version - also in French), which is a combined version of the three project newsletters.