



***Darwin Initiative for the Survival of Species***

***Annual Report***

**1. Darwin Project Information**

Project Ref. Number	162/12/008
Project Title	<i>DNA banking, phylogeny and conservation of the South African flora</i>
Country(ies)	<i>South Africa</i>
UK Contractor	<i>Royal Botanic Gardens, Kew (RBG Kew)</i>
Partner Organisation(s)	<i>South African National Biodiversity Institute (SANBI; formally the National Botanical Institute) University of Cape Town (UCT) University of Stellenbosch (US) University of Johannesburg (UJ, formally Rand Afrikaans University)</i>
Darwin Grant Value	<i>£116,187</i>
Start/End dates	<i>01/06/2003 – 31/03/2006</i>
Reporting period (1 Apr 200x to 31 Mar 200y) and report number (1,2,3..)	<i>01/04/2004 – 31/03/2005 Report 2</i>
Project website	<i><a href="http://www.sanbi.org/research/dnabank.htm">http://www.sanbi.org/research/dnabank.htm</a></i>
Author(s), date	<i>Dr Vincent Savolainen (RBG Kew, UK) &amp; Dr Gail Reeves (SANBI, South Africa) 29/04/2005</i>

## 2. Project Background

South Africa possesses a unique flora with three global biodiversity hotspots within its borders. The wealth of botanical knowledge and expertise in South Africa is reflected in its extensive herbarium collections, housed by both the SANBI and academic institutions. However, there is a pressing need for South Africa to take control of its genetic resources, and to utilize these accordingly. DNA banking represents one such avenue to address these short-comings, and therefore this project has enabled the financial input, in addition to skills and knowledge transfer, required to establish a truly modern biodiversity facility for high-profile research and conservation in South Africa.

## 3. Project Purpose and Outputs

At the outset of the funding cycle in 2003 the project aims were to (i) archive in a DNA bank the genetic material of at least one species from nearly all ca. 2000 South African flowering plant genera, of which 70% sp. are endemic; (ii) provide the necessary facility to extract DNA and preserve it appropriately, and to allow researchers to have access to plant DNA extracts to be used in applied and fundamental science; (iii) through collaboration with Kew's CBD Unit to implement the necessary legal agreements for material transfer and benefit sharing of these genetic resources; (iv) train South African researchers and students in high-profile biotechnologies; (v) produce a 'phylogenetic tree of life' of South African plant genera and to use this to identify areas of endemism and high priority for conservation.

The outputs have been modified over the last year in the following way. Our original collecting target (of one representative of every genus in the flora) has proved to be overly ambitious, and hampered by severe drought for two years running in the Northern and Western Cape (both areas of high endemism). In our half-year report we therefore amended our collecting target to 800 genera, although we have now substantially exceeded this target (1101 genera collected to date). As a result of this revised target we have also restricted our plans to build a phylogenetic tree using *rbcL* sequences to that of the Cape flora (which is made up of 947 genera), focusing on building a comprehensive tree for the Cape, we have also increased our sequencing effort from 500 *rbcL* sequences (initial target) to over 750.

## 4. Progress

The project had a very successful start during year one. During this time a DNA bank was established at SANBI, including purchase of an ultracentrifuge, and Ms Kholiwe Balele was appointed in a full time capacity as DNA bank manager (funded by the project for three years). Kholiwe subsequently spent one month at RBG Kew to receive in house training. In terms of legal agreements, an MoU was established between RBG Kew and the NBI (now SANBI), and SANBI modified their standard material transfer agreement to allow DNA samples to be passed to outside institutions through the DNA bank. Two workshops were held during the first year, one each in the UK and South Africa. In addition 26 students from South African universities attended a one-week course on 'Biotechnology and molecular techniques' at SANBI, and three PhD and eight MSc students now make use of the facility. In terms of publications, a chapter outline was drawn up for the proposed DNA banking manual, and a field guide (authored by J. Manning) was published well ahead of schedule. Difficulties were encountered in the first year with regard to attaining our collecting targets for the DNA bank. As a result SANBI drafted Ms Ingrid Nanni (SANBI staff member) to become involved in the project to assist with collecting permit applications and to help mobilise the botanical community to collect for the bank. Dr Felix Forest was also brought into the project (funded by UCT's Smuts' Memorial Botanical Fellowship) to assist in the collection of genera from the Cape Region, and to satisfy some of the scientific goals of the project through building a tree of life for Cape genera.

Progress has been monitored according to four main activities: (i) Workshops, (ii) Fieldwork and laboratory research, (iii) Courses, lectures and practicals and (iv) Manual, publications and publicity. Summary progress over the last year against the logical framework is provided in Annex 1.

#### **4.1. Workshops**

From 13-15 September 2004 a project workshop was held at the SANBI's Kirstenbosch Research Centre in South Africa attended by 32 participants. The broad aims of the workshop were to communicate to a South African audience some of the wider uses of a DNA banking facility, and to encourage participation from local academics and students in the initiative. The workshop was used as a vehicle to discuss the applied uses of DNA based methods in conservation and biodiversity science, including DNA barcoding and DNA based forensics for the wildlife trade. The DNA bank at SANBI is currently being utilised for both of these purposes. In addition presentations were made by three non-South Africans: Dr Vincent Savolainen (project editorial issues) and Ms Kate Davis (CBD issues for DNA banking) from RBG Kew, and Dr Angelique Corthals, curator of the Ambrose-Monell Cryo-Preservation Collection at the American Museum of Natural History in New York (tissue banking for animals).

The second workshop was also held in South Africa, in Cape St. Francis, from 16-18<sup>th</sup> March 2005, organised by I. Nanni (SANBI) F. Forest (UCT Smuts' Memorial Botanical fellow & SANBI) and R. Cowling (Nelson Mandela Metropolitan University – formally University of Port Elizabeth). The aim of this workshop was to bring together academics from South Africa and to take advantage of additional international expertise (Vincent Savolainen from Kew, Andrew Balmford from Cambridge, Jonathan Davies from the University of Virginia, and Dan Faith from the Australian Museum in Sydney) to discuss and explore the use of phylogenetic diversity measures from our project in practical conservation planning (see Annex 2 for list of participants). This proved to be an extremely successful workshop and an outcome of nine potential projects/papers was established for action over the next 12 to 36 months (see Annex 2, at least three of these papers will be submitted within the time frame of this project). In addition to measuring phylogenetic genetic diversity for the whole Cape Region it was agreed during this time which other data sets could be shared or accessed by the group to allow for diversity measures to be calculated at a conservation planning scale. As a result a further MoU will be established between RBG Kew and SANBI with regard to use of specific point locality data for the Cape Region (e.g. PRECIS distribution data). In addition to the Cape-focus of the present project, it was also decided to focus in the near future on the Gouritz River Biosphere Reserve (currently in the planning stages) as a means to investigate the value of phylogenetic diversity measures at a fine scale. This will allow the relative merits of phylogenetic information in conservation planning to be assessed, alongside other parameters used in the decision making process, in the context of real-life situations.

#### **4.2 Fieldwork and laboratory research**

During the last year collecting permits were renewed or acquired for the first time from Western, Eastern, and Northern Cape, Mpumalanga, Kwa-Zulu Natal and Limpopo Provinces. Collecting trips with the specific purpose of collecting for the DNA bank were organised to (i) the Cederberg (Western Cape) – this fieldtrip formed part of a follow up to the workshop held in Kirstenbosch in September and was attended by collaborators from SANBI, Kew, UCT and UJ; (ii) the Eastern Cape (UCT and SANBI); (iii) Mpumalanga (SANBI and Mpumalanga Parks Board), in addition to numerous local trips in the Western Cape involving reserve managers and reserve volunteers. The South African botanical community were also very much more involved in collecting on behalf of the DNA bank during the last year (with a contribution towards their expenses made from the Darwin Initiative funding), therefore collections were also made from Limpopo Province, Mpumalanga, the Eastern Cape, Western Cape and extensive collections from Kwa-Zulu Natal. This has

taken the total number of samples now archived in the DNA bank to 3840, representing 1101 genera and 2797 species. A total of 1168 samples have been extracted since the last annual report and an additional 104 samples representing a further 91 genera have been collected and are awaiting extraction. These DNA extracts are available by request to the Leslie Hill Molecular Systematics Laboratory and a full list of DNA extracts archived in the bank can be found on SANBI's website where updates are posted regularly. During the last year aliquots of DNA extracts for 123 species were requested from the bank by external researchers worldwide.

Since the last reporting period a new fully searchable database has been written for the DNA bank, by SANBI software developers, to allow more efficient and thorough analysis of the contents of the DNA bank. The database has been written in a format to allow a smooth transition to an online system, however this has not thus far been implemented for the following reason. On September 1<sup>st</sup> 2004 the NBI became the South African National Biodiversity Institute (SANBI) constituted under the National Environmental Management Act No. 10 of 2004. Since then the organisation has undergone an extensive information-review with regard to access to its many databases and all web-based developments have been put temporarily on hold. A new institutional-wide information strategy will be put in place during 2005 and the SANBI partners in the DNA bank project have requested that on-line access for the DNA bank database be made a priority, given the organisation's commitment to this in the MoU with RBG Kew. We therefore anticipate that the DNA bank database will be one of the first to be made available online during 2005.

The production of a matrix of *rbcL* gene sequences for the Cape flora has progressed well in the last year. Of the 947 genera currently recognised in the Cape flora of South Africa, 706 have been collected and are now stored in the DNA bank. A total of 647 genera have thus far been sequenced for *rbcL* (ca. 68% of the Cape genera) of which 537 are represented by Cape species and 110 by species not found in the Cape. Of these 647 *rbcL* sequences, 335 are unpublished sequences and have been produced as part of this project, the remainder (312) have been downloaded by F. Conrad (SANBI) from public databases. Most DNA sequencing has been done at Kew; 257 were produced by F. Forest (Smuts postdoctoral fellow), 70 by Evan Arnold (Chicago University intern) and eight by Ntsikelelo Lester (UWC intern based at Kirstenbosch). A total of 199 genera still remain stored in the bank and will be sequenced for *rbcL* (scheduled to be done by Felix Forest at Kew in June/July 2005; total sequencing effort will encompass 82% of the Cape flora).

### 4.3 Courses, lectures & practicals

The DNA bank at Kirstenbosch hosted two one-week practical training courses for South African students during the last year. The first during October 2004 was attended by five students from UWC, and the second (during March 2005) by eight students from UCT, Stellenbosch and UWC. The second course included a lecture from Vincent Savolainen on international efforts on 'Assembling the tree-of-life'. Two female students have completed their MSc dissertations during this period. Supervised by G. Reeves, Angeline Khunou (SANBI staff member and student) was awarded her MSc degree in June 2004 on 'Species delimitation and assessment of genetic variability in *Carpobrotus* (Aizoaceae): evidence from amplified fragment length polymorphisms'. Supervised by G. Reeves and project partner T. Hedderson (UCT), Jessica Da Silva (UCT and SANBI) also submitted her MSc thesis entitled 'Conservation genetics of the critically endangered South African cycad species *Encephalartos latifrons*' in March 2005. Also from Kirstenbosch (in partnership with UWC and UCT), Amelia Mabunda and Graham Rowe will both be submitting their MSc. theses during 2005. From the University of Johannesburg, another two female students, Collette Robinson and Cynthia Motsi have also been awarded their MSc degrees under supervision of project partner Dr Michelle van der Bank. Cynthia Motsi

has also carried out some of her laboratory work at Kew, and Colette Robinson this year won the UJ award for 'best botany student' for her Msc work. Another four students from UJ should be finishing their Msc this year: Nicole du Toit, Anemari van Niekerk, Jerminah Moeaha, and Paul Naude. Paul Naude has visited Kew's molecular section for his work (with external money raised by V. Savolainen from the Bentham Moxon Fund) and another MSc student from UJ, Stephen Boatwright, will be visiting Kew later this year.

#### 4.4 Manual, publications and publicity

The proposed manual entitled 'DNA and Tissue Banking for Biodiversity and Conservation: Theory, Practice, and Uses', edited by V. Savolainen, M. Powell, K. Davis, G. Reeves & A. Corthals has been completed and will be jointly published by Kew and the World Conservation Union (IUCN) later this year. The manual consists of 17 chapters and contains contributions from 31 authors (see Annex 3; > 47,000 words). The contents include case studies involving DNA banking initiatives from Australia, Costa Rica, South Africa and the UK, in addition to extensive material on the legal and CBD requirements to be considered within the context of DNA banking. The manual also includes information with regard to banking of tissue samples and thus steps outside the scope of plant DNA banking.

Four peer-reviewed publications have been published during this reporting period based on the project network and DNA resources. Perhaps most significantly our DNA banking initiative received considerable attention through a letter published in *Science* (2004, 304:1445), authored by V. Savolainen and G. Reeves and entitled 'A plea for DNA banking'.

A briefing document was also prepared and submitted to the South African parliamentary portfolio committee on Environmental Affairs and Tourism (dated February 2005) entitled 'DNA based approaches to biodiversity science and conservation in South Africa.' This was followed up by a presentation to the committee by G. Reeves and A. Mabunda (SANBI and UWC MSc student). The committee discussed the Darwin Initiative DNA banking project at length, and members were particularly interested in the training and capacity building aspects of the project.

In partnership with Gauteng Nature Conservation a presentation was made to Working Group 1 (comprised of the CEOs of the provincial nature conservation authorities in South Africa) with regard to the potential use of DNA fingerprinting technology in the conservation of cycad species threatened by trade. SANBI's DNA bank was also included in the presentation and discussed as an integral component of any long term forensic efforts.

One newsletter of SANBI's plant conservation projects was also published November 2004 featuring SANBI's DNA banking program (see enclosed copy).

G. Reeves and V. Savolainen attended the Evolution meeting in Fort Collins, Colorado (June 2004) where G. Reeves made a presentation in a special symposium on Systematics and the CBD. After this meeting both went to a meeting at the University of Zurich dedicated to understanding plant radiations in South Africa. Savolainen and Reeves presented talks about the project; and one student from US (K. Oberlander) subsequently came to Kew for one week to work with V. Savolainen on his PhD. Gail Reeves also went to the VII International Cycad conference in Mexico to present a talk on "Conservation genetics of South African cycads *Encephalartos*". This was also followed up by a presentation at Cambridge University's Conservation Biology Conference for young scientists by Jessica Da Silva. Jessica presented a poster on her DNA fingerprinting work on the endangered cycad *Encephalartos latifrons*, and was awarded third prize.

F. Forest and F. Conrad from SANBI attended the first international DNA barcoding conference, of which V. Savolainen was a member of the Scientific Committee. V. Savolainen is currently editing a special issue of the *Philosophical Transactions of the Royal Society* (London) on this topic where the current project will be publicised. F.

Conrad also received a travel bursary from the Consortium on Barcoding Life to present our DNA banking project via a poster, where the angiosperm generic phylogeny was linked with DNA barcoding. Felix Forest's trip was covered by a Bentham Moxon grant raised by V. Savolainen.

#### **4.5. Workplan for final reporting period**

June 2005: Attendance at the Evolution meeting (Fairbanks, Alaska) by Felix Forest and Vincent Savolainen who will both give presentations of project outcomes (phylogenetic diversity and conservation in the Cape).

July 2005: visit to Kew by F. Forest to finish the *rbcL* sequencing programme

August 2005: Cape phylogenetic tree produced; visit by Kew's DNA bank managers to the SANBI DNA bank to duplicate extracted samples at Kew and update protocols with K. Balele

September 2005: plant collecting in Kwa-Zulu Natal. V. Savolainen will also liaise with other South African Darwin projects

December 2005: manual on DNA banking to be published; paper on Cape phylogenetic diversity and conservation submitted (target journal: *PNAS*)

January 2006: conservation workshop in South Africa and university training

February 2006: exit strategy implemented

March 2006: end of project

### **5. Actions taken in response to previous reviews**

#### **5.1. Phylogeny coverage**

The reviewer commented that it was not clear from the original proposal or annual report what the master plan was for producing a phylogeny of the South African flora – since we only proposed to sequence *rbcL* for 25% of genera. In response to this we have decided to focus our phylogenetic reconstruction on genera occurring only in the Cape Region (sensu Goldblatt and Manning 2000). This floristically diverse but distinct region is comprised of 947 genera and we have 706 of these genera represented in the DNA bank (our collecting program during the last year has thus focused on acquiring as many Cape genera as possible). So far 647 *rbcL* sequences have either being generated or downloaded from GenBank and the remainder will be produced by July 2005, allowing time for subsequent analyses. With project partners Drs Reeves, Manning and Hedderson, Dr F. Forest has successfully been able to extend his Smut's fellowship at UCT for a further year (until February 2006) and thus we have the resources and manpower to complete a tree-of-life for Cape genera by the end of the project in 2006. However, we will not attempt to build a tree of all South African genera as originally planned due to time and resource constraints.

#### **5.2. From genes to conservation**

The reviewer also queried how the process of going from a DNA bank and a *rbcL* phylogenetic tree to real changes in conservation and bioprospecting strategies will be realised, and how the phylogenetic information coming from the generic *rbcL* tree will be used in conservation and integrated with other information sources. We have given a great deal of thought to these issues over the past few years and organised a workshop to address this topic and to bring together conservation planners and evolutionary biologists/geneticists. Our intention is to use the *rbcL* tree for the Cape Region to produce phylogenetic diversity (PD) indices for the Cape Region. This workshop was co-organised by Prof. Richard Cowling, one of the foremost conservation scientists in South Africa and included participants from a wide range of backgrounds including Dr Daniel Faith (original author of PD measures), Dr Mathieu

Rouget (head of GIS and Conservation Planning at SANBI), Prof Andrew Balmford (conservation biologist, Cambridge University) and Dr Jonathan Davies (PD specialist at Virginia University). In short, we will evaluate if areas of higher PD (evolutionary history) have also received priority for conservation (protected areas) in the Cape. So far, PD has not been used at generic levels because the ages of unsampled species within genera can heavily bias the calculations. Using large phylogenies at sp-level, we will also evaluate if the PD of genera is a good surrogate of species PD. More specifically we aim to address the following questions. Are areas of higher species and generic PD significantly matching protected areas? Using large phylogenetic matrices (Cape genera and more detailed species-level trees), we can calculate species PD (branch lengths in dated ultrametric trees) per quarter of degree square and see if higher PD falls within categories of (un)protected areas. Significance can be calculated by randomly assigning taxa to the tips of the phylogenetic tree and recalculating PD for each square: we would expect that, on average, 'protected' squares have higher PD. Do protected areas contain highest amounts of total PD ('ideal conservation plan')? Total species PD can be calculated for the sum of squares included in protected areas and compared to randomly assigned 'protected' squares covering the same size. In addition, how does total PD for protected areas correlate with higher species and generic diversity? We also aim at making comparison with mammals; this is particularly relevant here since mammals are comparable in numbers to angiosperm genera and they are roughly the same age. Ultimately we know that in itself PD cannot be the ultimate factor upon which to decide conservation priorities, but these kind of indices are extremely valuable in modern conservation science or at least as a supplement to 'sell' conservation actions and reserves design.

### **5.3. Training in biotechnology**

The reviewer queried the planned scope of training in genetic resource management and biotechnology. In addition to an introduction to DNA banking and the practical techniques required to extract DNA from plants, the one-week course run by Kirstenbosch introduces students from universities across the country (many of whom have no experience in molecular biology techniques) to DNA sequencing methods and analysis from both a practical and analytical standpoint. This includes an introduction to PCR, sequencing and phylogenetic reconstruction. We use our tree of life project for the Cape flora as a specific reference point throughout the course and highlight the importance of phylogenetic methods in conservation (i.e. all species are not necessarily equal in evolutionary terms), and bioprospecting (i.e. how phylogenetic trees can help to understand taxonomic boundaries and also make the search for natural products more efficient). Many of the students have an interest in the applied uses of the South African flora (e.g. some have studied in the Applied Herbal Sciences Institute at the University of the Western Cape). In collaboration with the course co-ordinators we have made the short-course an integral part of their honours year, and use it as an opportunity to impress the importance of well-curated collections (both of DNA extracts and herbarium samples) when bioprospecting for medicinals and other natural products. In tandem with this, the taxonomic and phylogenetic aspects also highlight the importance of 'knowing what we are working with'.

### **5.4. Field Guide**

The reviewer commented that it was not clear how the field guide 'A photographic guide to the wildflowers of South Africa' related to the Darwin proposal. Unfortunately when we submitted the funding application we were not aware that our proposal to publish a field guide for genera of the Cape flora was already in progress by Terry Trinder-Smith, of the Bolus Herbarium, UCT. Therefore upon successfully receiving funding from the Darwin Initiative we had to realign our plans so as not to duplicate this. Upon consultation with project partner J. Manning, we decided that the wildflower book, whose concept had already been accepted by publishers, would provide us with a useful alternative. We hope that the reviewers agree that this is a worthwhile publication and contributes substantially to the general public's knowledge

and appreciation of the unique local flora. Most of the cost of the publication was incurred by the publisher and not by the Darwin Initiative.

### **5.5. Plant collecting**

The final query by the reviewer addressed whether down-scaling of the collecting targets for the bank would have any serious implications for the project. Despite a very productive collecting season during the last year we will not be able to reach our initial target of one representative of every genus in the South African flora. Our new targets for 2004/5 were to collect at least 80% of the genera present in the Cape Region. This target has been met. During the last year of the project we aim to collect as many as possible from the remaining 20% genera in the Cape, and also to continue collecting in other parts of the country. We will particularly focus on Kwa-Zulu Natal where we hope to achieve collection of a further 200 genera. There are several reasons for concentrating on this province, firstly due to the successful mobilization of collectors in Kwa-Zulu Natal, which we would like to capitalise on, and also because this region contains very different elements to those found in the Cape. We believe that due to our revised tree-of-life objectives (i.e. to focus on the Cape Region) down-scaling of the collecting program will not have adverse implications for the project or any of our proposed outcomes.

### **6. Partnerships**

Gail Reeves, project co-ordinator in South Africa, has resigned her post as Head of the Leslie Hill Molecular Systematics laboratory at SANBI, which hosts the South African DNA bank. This decision was motivated by personal choices and maternity leave back in the UK, her country of citizenship. However, all other staff arrangements at the Leslie Hill Molecular Laboratory remain unchanged and all partners will continue to interact as usual within the project framework; Ms Ferozah Conrad, Ms Ingrid Nanni and Dr John Donaldson, Director of the Kirstenbosch Research Centre, are the primary contact project partners at SANBI. Gail Reeves is also still employed by SANBI as a consultant until December 2005 to finish off this project with some continuing co-ordination duties. The partnership arrangements at UJ, UCT and US remain unchanged.

### **7. Impact and Sustainability**

The project continues to have a very-high profile within the country and on the international scene. For example, the Moore and Sloane foundations have shown considerable interest in plant DNA banking and barcoding, and as a result they have invited RBG Kew and SANBI, among others, to submit a 18-month 800K US\$ project to initiate plant DNA barcoding for conservation (project led by Darwin Kew partner M. Chase submitted April 2005). Also, in order to continue in her capacity as DNA bank manager after the Darwin Initiative funding, Ms Kholiwe Balele's post has been approved on a permanent basis and her salary will be taken on by SANBI from next year onwards.

### **8. Post-Project Follow up Activities (300 words maximum)**

We foresee that the project exit strategy will be implemented easily. The bank is also likely to expand to include animal collections with SANBI's appointment of a herpetologist as incoming head the Leslie Hill Molecular Systematics laboratory. However, given the formidable data production and networking activities of the past years, several scientific aspects are now taking off and deserve further attention. Therefore, we would like to apply for a 2-year project extension with the objectives to (i) co-ordinate the scientific research described in annex 2, tightly linking conservation planners, evolutionary geneticists and ecologists; (ii) build on the imminent publication by the IUCN of the complete red list for the South African flora and calculate extinctions risks for three biodiversity hotspots; (iii) transfer knowledge to in-country scientists, students and conservationists with regard to the use of phylogenetic data and DNA barcodes; (iv) integrate the human dimension and services in complement to



genetic-based conservation assessments; (v) publish concerted conservation actions with current partnership and new ones to be developed (e.g. with another two Darwin projects in South Africa). Two new partners would join this second phase: Dr Andrew Balmford (University of Cambridge, UK; author of 'Integrating costs into conservation planning across Africa' in press in *Biological Conservation*, 'The convention on biological diversity's 2010 target' *Science* 307 (2005)); and Prof Richard Cowling (University of Port Elizabeth, RSA; 'Nature conservation requires more than a passion for species', *Conservation Biology* 18 (2004)). We would propose to hire at Kew a Darwin Project Officer, for a period of 18 months, fluent in computing/conservation statistics, who will spend 50% of his/her time in the UK and 50% in South Africa, with significant matched funding from SANBI. Due to the multi-disciplinary and inter-sectorial aspects of these activities, they will support several articles, targets and themes of the CBD.

## 9. Outputs, Outcomes and Dissemination

All targets met or exceeded as detailed in Table 1 below.

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

Code No.	Quantity	Description
2	2 passed, 2 submitted	Msc students at UJ, UWC and UCT
4A/C	13	Undergraduates (9) and post graduates (4) receive training in molecular techniques & biotechnology for conservation
4B/D	1 per student (total 13 weeks)	weeks training
5	1	DNA bank manager received ongoing training
6	7	members of staff attended 2 workshops
7	1	DNA banking manual submitted
8	6	weeks spent by UK staff in South Africa (Savolainen & Davies spent 2 weeks in Sept. 2004, Savolainen spent 2 weeks in March 2005)
11A	4	papers published/accepted (Table 2)
11B	2	cycad paper to be submitted to Cons. Biol. and Phylogenetic diversity paper
12A	1	1 Access database hand over to SANBI and subsequently imported in a newly developed in house database
13A	1	DNA bank
13B	1	Herbarium vouchers for DNA bank
14A	2	2 workshops organised (Sept/March)
14B	5	conferences attended: Evolution meeting, Zurich meeting, Barcoding in London, Cycad in Mexico, Conservation Biology in Cambridge
15B	1	item in SANBI newsletter
17B	1	'Barcoding of Life' and 'SABBiG South African Big Genera Group' networks enhanced

19A	1	1 radio interview of G. Reeves on the Johannesburg National Radio Station
21	1	DNA bank facility still in place

**Table 2: Publications**

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (e.g. contact address, website)	Cost £
journal	Davies, T. J., T. G. Barraclough, V. Savolainen and M. W. Chase. 2004.	Royal Society, London	Environmental causes for plant biodiversity gradients. Phil. Trans. Roy. Soc. B. 359: 1645-1656.	0
journal	Davies, T. J., V. Savolainen, M. W. Chase, P. Goldblatt, T. G. Barraclough.	ASN	In press in Am. Nat. Energy, area and diversification in the species-rich flowering plant family Iridaceae.	Cost covered by Imperial College London
Book chapter	Savolainen V., Forest F. Species-level phylogenetics from continental biodiversity hotspots: case studies in South Africa and South America.	ASPT	In press in Regnum Vegetabile.	0
journal	Savolainen, V., Reeves, G, 2004	AAAS	A plea for DNA banking, Science 304:1445	0
manual	Savolainen V., Powell M., Davies K., Reeves G., Corthals A. eds	Kew and IUCN	In press	not yet fully incurred, see Table 3

## 10. Project Expenditure

**Table 3: Project expenditure during the reporting period (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
Rent, rates, heating, overheads etc	0		0	0

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## **11. Monitoring, Evaluation and Lessons**

The Logical Framework Approach to project management has been applied throughout the project, with monthly monitoring of indicators of achievement being taken from the Logframe jointly designed by V. Savolainen & G. Reeves, and where links between objectives and outputs were made explicit. Although an 'online' monitoring website could not be set up (see 4.2), numerous emails and phone contacts between G. Reeves/I. Nanni and V. Savolainen have allowed for regular updating and monitoring all key figures of the Logframe. Apart from the largely inevitable hiccups due to long-distance and multi-partner management of such an ambitious project, the trans-national UK-South African partnership has remained excellent and continues to develop at an ever-growing rate.

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

In the last year we have been able to compile the first comprehensive manual on DNA banking for use by biodiversity and conservation scientists. We hope that this manual will represent an important contribution to the field, particularly in the new era of DNA barcoding and the applied use of DNA technologies in conservation science and wildlife forensics. Our DNA banking efforts have also received significant endorsement through the Sloane and Moore Foundation's interest in plant DNA banking, and barcoding for species identification. As such RBG Kew (along with partners from this Darwin Initiative project) have applied for funding to take the plant DNA barcoding initiative forward. During the last year we have been able to bring together evolutionary biologists and conservation planners and scientists to explore the existing, or potential contribution, of phylogenetic diversity measures in the conservation decision-making process. This has generated much excitement within the applied and basic scientific community in South Africa and we hope to capitalise on this momentum in the coming year. Finally, we have been able to disseminate our project activities to a wide audience in the last year, including the general public via radio and government officials via the Environmental Affairs and Tourism Portfolio Committee, as well as via a letter in the prestigious journal '*Science*'. This has engendered widespread interest in the project and highlighted the pressing need to implement DNA banking strategies in bio-diverse rich-countries such as South Africa.

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