

**Darwin Initiative – Final Report**  
**limbovane Outreach Project:**  
**Exploring South African Biodiversity and Change**  
**March 2009**

**Darwin project information**

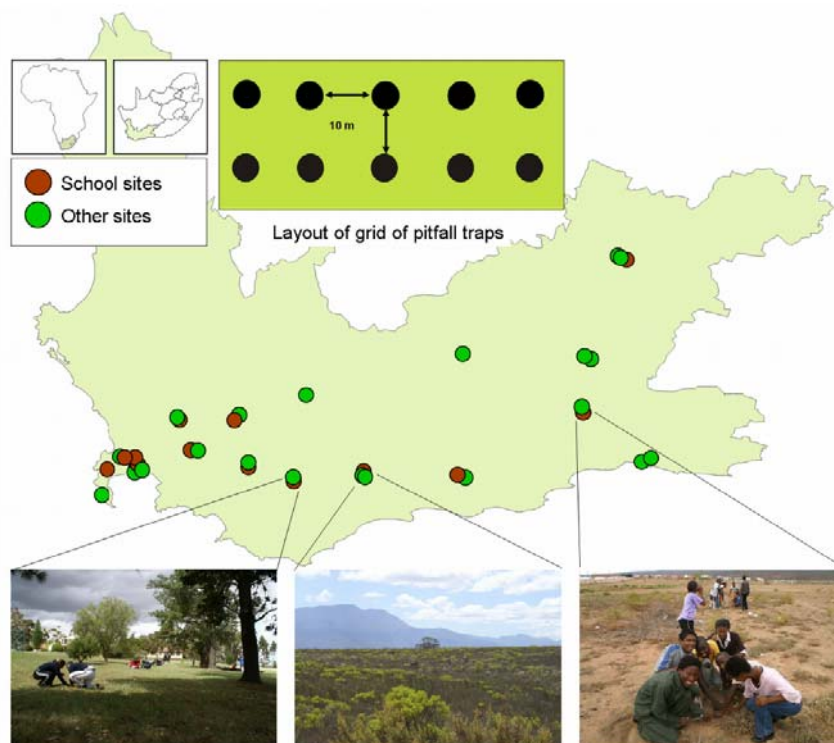
Project Reference	14012
Project Title	limbovane Outreach Project: Exploring South African Biodiversity and Change
Host country(ies)	South Africa
UK Contract Holder Institution	Biodiversity and Macroecology Group – University of Sheffield (UoS)
Host Country Partner Institution(s)	DST-NRF Centre of Excellence for Invasion Biology (C-I-B) – University of Stellenbosch
Darwin Grant Value	£286,892
Start/End dates of Project	1 October 2005 – 31 December 2008
Project Leader Name	Professor Kevin J. Gaston
Project Website	www.sun.ac.za/iimbovane
Report Author(s) and date	Sue Shaw, Kirsten Mahood, Brigitte Braschler, Steven Chown and Kevin Gaston; December 2008.

**CONTENTS**

1	Project Background	2
2	Project support to the Convention on Biological Diversity (CBD)	2
3	Project Partnerships	4
4	Project Achievements	6
4.1	Impact: achievement of positive impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits	6
4.2	Outcomes: achievement of the project purpose and outcomes	7
4.3	Outputs (and activities)	7
4.4	Project standard measures and publications	10
4.5	Technical and Scientific achievements and co-operation	10
4.6	Capacity building	10
4.7	Sustainability and Legacy	11
5	Lessons learned, dissemination and communication	11
5.1	Darwin identity	13
6	Monitoring and evaluation	13
6.1	Actions taken in response to annual report reviews	14
7	Finance and administration	14
7.1	Project expenditure	14
7.2	Additional funds or in-kind contributions secured	14
7.3	Value of DI funding	15
Annex 1	Report of progress and achievements against final project logframe for the life of the project	16
Annex 2	Project's final logframe, including criteria and indicators	18
Annex 3	Project contribution to Articles under the CBD	20
Annex 4	Standard Measures	22
Annex 5	Publications and other publicity materials	25
Annex 6	Darwin Contacts	29
Annex 7	Selection of photos illustrating various aspects of the project.	30
Annex 8	Methodology, results.	36
Annex 9	Publicity	41
Annex 10	Quotes and Anecdotes	44

# 1 Project Background

The limbovane project (based in Western Cape Province, South Africa) has successfully combined scientifically rigorous monitoring of ants with participation and education at secondary school level to provide new information on ant diversity patterns over large spatial and temporal scales, and investigate land-use and climate change impacts. Nine curriculum advisers, 32 teachers and over 3400 learners have been trained and their knowledge of biodiversity and ecosystem functioning, and their change over time have been improved. Reference collections, databases, ant identification keys, a teaching manual and scientific publications have been produced. The continuation of the project has been secured.



Map showing the location of school and control sampling sites in the Western Cape of South Africa

## 2 Project support to the Convention on Biological Diversity (CBD)

This project has assisted South Africa in implementing the following Articles of the CBD:

**Article 7 Identification and Monitoring.** Ants are key elements particularly of Fynbos ecosystems in the Cape Floristic Region especially because approximately 20% of the 6500 strictly Fynbos plant species are dependent on myrmecochory (ant-assisted seed dispersal). They are thus associated with key evolutionary processes in the most floristically diverse region in Africa (and globally the smallest Floral Kingdom). This region is predicted to be affected substantially by climatic change over the next 50 years, and yet no invertebrate monitoring schemes were previously in place, and especially not for species which are key also to plant reproduction. It is also clear from South Africa's second report to the CBD that invertebrate monitoring and inventorying is poorly developed. This work has made a key contribution towards establishing a monitoring and inventory programme for an important group of insects, which are also widely agreed to be excellent indicators of the effects of landscape change.

**Article 8 In situ Conservation.** This work has provided the information necessary for sustainable management of biodiversity outside and within protected areas (part of the sampling has been done in the Greater Cederberg Biodiversity Corridor, and 13 of the 33 sites (including schools) are within national parks or nature reserves), by making available spatially explicit and temporally extensive information on ants in the area of interest (Article 8c). It also enables assessment of changes in the distribution of established alien species (such as Argentine ant), and arrival of new alien species by providing baseline information on ant assemblages at a variety of sites across many years, so enabling action to be taken in a timely fashion. Once again, South Africa's second report to the CBD makes it clear that there is little in

the way of such assessment and monitoring work being undertaken for invertebrates (Article 8h).

**Article 12 Research and Training.** The major element of this work has been to build capacity, knowledge and interest in the field of invertebrate biodiversity, and to promote an appreciation of spatial and temporal variation in diversity and the implications of changes thereof for conservation. It therefore addresses education at the level of local communities and especially learners in whose hands the future of biodiversity will rest. The work contributes not only to the formal education of learners, but also to their appreciation of the effects that landscape alteration can have on biodiversity and of the importance of sustainable use of the environment. Ant sampling, and communication regarding the differences in species and assemblages that are characteristic of different sites sampled by schools, using modern technology, enables learners to understand the variation in diversity and at the same time develop an appreciation of the power of information and communication technology to make such knowledge more accessible. At the same time, the information collected provides the basis for formal research into the distribution and assemblage structure of ants, and the way these are changing in response to a variable and changing environment in the Cape Floristic Region (which extends to the eastern Cape).

**Article 16. Access to and Transfer of Technology, Article 17. Exchange of Information, Article 18. Technical and Scientific Cooperation.** A major outcome of this work is the provision of spatially explicit information and keys to ants that have been made accessible either by CD or via the internet. The full set of resources will be made openly available once the scientific results have been published. Keys have been developed using digital imagery and are also available in hard copy. Schools are able to compare their work across the area. There has been transfer of technology and information required for this between the UK and South Africa, as well as substantial exchange of scientific skills and information to ensure that sampling and analysis were set-up and done in such a way that South Africa derives maximum benefit from the commitment of resources and expertise both from the UK side and via its own investments.

Cross-cutting Theme. The project is cross-cutting in its approach in that it makes use of school learners to assist with a monitoring programme for biodiversity that contributes to understanding of spatial and temporal variation in a poorly comprehended portion of South Africa's biodiversity. Thus, it simultaneously contributes to several Articles of the CBD as indicated above.

The Framework Convention on Climate Change Country Studies Programme for South Africa identified major constraints in this regard, including: (i) Knowing how species are distributed in the matrix and how these distributions are changing. In South Africa, there is virtually no annual monitoring of biodiversity, with the exception of water bird counts and smaller-scale monitoring of selected taxa within individual protected areas; and (ii) Convincing ordinary, often poor, people to care about these issues and the future well-being of biodiversity. Many rural poor have other issues to contend with before worrying about biodiversity.

The South African National Environmental Management: Biodiversity Act (Act 10 of 2004) specifically requires that monitoring mechanisms and indicators are set in place to determine the conservation status of components of South Africa's biodiversity and negative or positive trends affecting the conservation of biodiversity (Section 49). The Act also requires that a monitoring system for alien and invasive species be set in place (Section 76). The South African National Biodiversity Institute (SANBI) established by the Act (Section 10) is mandated to monitor biodiversity in the country (Section 11), and has indicated that it will seek partnerships with various organizations to undertake this work. It has already done so via the collaborative ventures under the umbrella of the National Spatial Biodiversity Assessment (NSBA), and the National Biodiversity Strategy and Action Plan. The limbovane project has contributed substantially to addressing these national goals within a regional framework.

The commitment by C-I-B to support the project beyond the life of Darwin funding will ensure that the above contributions to meeting South Africa's CBD objectives and commitments are continued.

The C-I-B has strong links with the South African National Biodiversity Institute (via a Memorandum of Understanding), which is the premier biodiversity organisation in South Africa, responsible for implementing many requirements of the CBD on behalf of the Department of

Environmental Affairs and Development planning, which is the CBD focal point for South Africa. SANBI has been fully briefed about the project, specifically via one of its Chief Directors (responsible for policy and planning), who serves on the C-I-B Board. Moreover, a process has been set in motion such that the biodiversity information from this project (i.e. ant distribution and abundance data) will be captured by the BGIS (Biodiversity GIS) database (see <http://bgis.sanbi.org>) for broader use in conservation planning and decision-making. This will ensure long-term take up of the data for biodiversity planning purposes and will help South Africa also to meet several of its obligations to the CBD. The host country partners have also been working with the Department of Environmental Affairs and Tourism in providing advice for the development of regulations for Chapter 5 of the National Environmental Management: Biodiversity Act, which deals with alien and invasive species.

The C-I-B has also developed a working relationship with the South African Environmental Observation Network. SAEON is a research facility of the National Research Foundation of South Africa (NRF) that establishes and maintains environmental observatories, field stations or sites, linked by an information management network to serve as research and education platforms for long-term studies of ecosystems. The aim of these sites, or *nodes*, is to provide for advances in current understanding of ecosystems and the nation's ability to detect, predict and react to environmental change. The C-I-B is in ongoing discussion with SAEON about how activities for the Fynbos node and the C-I-B's activities, and especially via the limbovane project, can be integrated. The Fynbos node of SAEON is hosted by SANBI, and in consequence the three-way interaction is firmly established, including a direct link to policy planning and an indirect link to the host country CBD focal point.

### 3 Project Partnerships

The partnership between the UoS and C-I-B has worked well from the beginning, with assistance coming from both partners. The PIs were in  $\pm$  weekly contact via e-mail and by voice over internet discussions. Dr. Shaw and Ms. Mahood were in regular email contact regarding administrative issues relating to the project, ensuring sound overall project management. Dr. Braschler (UoS) remained in South Africa for longer than originally anticipated, and kept in touch with the UK or South African partners through regular e-mails. Whilst in the UK she had computer access to the South African data management system where all data collected and products developed by the project are housed.

An MoU between the University of Sheffield and C-I-B was signed early on in the project.

One of the strengths of the project was an annual workshop of project partners from the UK and South Africa, at which progress was reviewed and plans for the next period discussed. Involvement of all the staff and meeting face-to-face were found to be particularly valuable and productive.

The partnership with Western Cape Education Department (WCED) has been particularly successful. WCED continues to request the limbovane project to be rolled out to all 360 secondary schools within the Western Cape.

Collaboration with researchers within the C-I-B who are undertaking ant biodiversity studies (see 3<sup>rd</sup> Annual Report to Darwin) is ongoing and limbovane staff continue to provide advice on and identification of species for other researchers. Indeed, on the basis of this work, further plans for the investigation of ant diversity variation across the country, including a major outreach component in some areas, have now been formulated among host country partners. This work will commence in 2009 and is the direct result of the substantial interest in and data concerning ant diversity generated by this project. Those involved in the host country from 2009 onwards include the Universities of Venda, Pretoria and Stellenbosch.

#### **Other Collaboration:**

Collaboration and co-operation with a number of host country organisations has been ongoing throughout the project. limbovane maintains sampling sites in the South African National Parks (SANParks). Co-operation with SANParks is ongoing and all necessary permits for continuation of the sampling have been renewed. Students working within SANParks have accompanied the limbovane team on sampling visits when they are available. A select group of Coastcare employees have assisted with sampling in Wilderness National Park, receiving on-the-job

training in data collection. Further work in SA national parks, especially on the invasive argentine ant, will commence in 2009 via a new Memorandum of Understanding that is presently being negotiated.

The relationship with the Western Cape Nature Conservation Board (CapeNature) is ongoing. The permit for ant sampling has been renewed until 2012. This extended permit period is an indication of the value CapeNature places on the limbovane work. The relationship with the City of Cape Town continues to develop. Students working for the City of Cape Town have assisted with fieldwork when they are available. The partnership with the Iziko Museum of Cape Town is ongoing. This partnership is vital as it provides taxonomic guidance in the development of the reference collection and assists in the development of taxonomic skills within the limbovane team, thus further building capacity in South Africa.

Two new partnerships have developed relatively recently. The first is with the South African National Survey of Arachnida (SANSA). Samples collected by the limbovane team (once all ants have been removed) will be sent to SANSA for further analysis of all arachnids captured by the pitfall traps. This is an extremely meaningful partnership, as the data collected by limbovane is being used to broaden the distribution knowledge for a host of other invertebrates, creating a multiplicative impact in the generation of knowledge of South Africa's biodiversity.

The second partnership is with the Discover Life group based at the University of Georgia, United States of America. Discover Life run various community-based ecological data collection projects within the USA. One of these projects is Ant Hunt, a project very similar to limbovane, where community members collect ants to provide information on ant distributions in the north eastern region of the USA. Together with Discover Life the limbovane team put forward a proposal to host a special session at the August 2008 *Ecological Society of America* conference in Milwaukee (Wisconsin). The special session was held on 5<sup>th</sup> August 2008, co-organized by Lara B. Pacifici from the University of Georgia, and Kirsten Mahood of the C-I-B. The workshop session was titled "Projects Linking Science Research and the Community" and covered best practice in outreach and ecological research projects and methods to ensure that both science or community interaction goals are reached and maximised. The limbovane project formed a special topic of discussion, and several additional collaborations were developed in consequence, including researchers at Duke University and the University of California – Davis. These researchers are very interested in working with the limbovane project to develop an assessment tool to investigate the effectiveness of the limbovane project on changing attitudes towards environmental issues as well as the impact of the project on learners' environmental literacy. These interactions are a major advance for the project in terms of awareness of the project outside of South Africa. There is also now excellent potential for interactions with a broad range of researchers in the next phase of the project.

There have been substantial interactions with SANBI, via meetings and discussion, as to how outreach projects in the sector can best be run. The C-I-B and SANBI have also discussed ways to further the use of data generated by the limbovane project for planning and policy purposes.

Finally, two interactions with U.K. institutions took place. First, the C-I-B hosted Mr. Peter Gabriel, a Masters student from the University of York. He worked with Prof. S.L. Chown on the impact of disturbance and argentine ant invasions on ant body size frequency distributions (as a measure of functional diversity change), using the limbovane data from four sites. Mr. Gabriel's project was entitled 'Using the size-grain hypothesis to assess functional change in communities subject to multiple disturbance regimes', and he did very well in his final assessment at York. Second, a collaboration with Dr. Catherine L. Parr at the School of Geography and the Environment, Oxford University, regarding ant diversity in southern African environments, was established and will be expanded in 2009.

## 4 Project Achievements

### 4.1 Impact: achievement of positive impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

This project has had, and will continue to have, an impact on biodiversity conservation (although mostly in an indirect way) in three important ways:

First, understanding of the spatial (and increasingly temporal) patterns in ant diversity has been increased substantially. It is now clear that, unlike many other areas of the world, ant diversity in this region is not only related strongly to environmental temperature, but also to primary productivity, which is in turn closely related to mean annual rainfall. This finding suggests that it is not only temperature change that will affect ant assemblages, as global climate change is realized regionally, but that changing precipitation regimes and amounts will be of considerable consequence too. Given that precipitation change is one of the most significant changes forecast for Southern Africa, and especially for the region in which the project is underway, the results highlight the significance of understanding better the relationship between water availability and ant diversity. The outcomes also draw policy attention to the fact that whilst understanding and forecasting the impacts of temperature change are significant for some areas of the globe, here, forecasting and understanding the impacts of precipitation change are paramount. This means that greater emphasis will have to be placed on forecasting precipitation change (a major challenge for downscaling the outcomes of General Circulation Models at present), and on developing strategies to mitigate the impacts of such change on local biodiversity. These messages come at an especially timely point as South Africa is preparing its second country report to the United Nations Framework Convention on Climate Change, and as part thereof is further developing mitigation adaptation strategies.

Second, this project has benefitted formal biodiversity conservation in two ways. (1) it has provided, and will continue to provide information on a little known taxonomic group for the protected areas (reserves and national parks) that house the untransformed sites. The conservation agencies responsible for these areas struggle to acquire such information themselves and are reliant on outside assistance to do so. This information assists with conservation assessments and planning for these areas. (2) by demonstrating that conservation areas do function to protect diversity, and by demonstrating the effects of environmental change (especially invasion and transformation) on local assemblages the project also provides conservation authorities with an argument at the political level that the effects of human actions are not just realized elsewhere, but are happening domestically too, and that conservation areas are effective. In domestic political debates, local demonstrations of impacts on biodiversity (impacts scientists may consider virtually axiomatic) are an especially powerful way of justifying the need for sound domestic conservation policy and investment. Such arguments are important especially for agencies that derive a significant portion of their budget from the National Treasury, and must therefore have strong arguments for competing with other National priorities, such as housing, health, and agriculture.

Third, the project has changed the world view of several thousand learners and many teachers, so reducing the 'extinction of experience' that is such a major modern concern. By combining survey and monitoring work with education and outreach the limbovane project has moved away from an 'information download' approach. The dual approach means real integration of an appreciation of biodiversity and knowledge of how to assess it into the daily lives of people not routinely exposed to it. Moreover, this reach has been extended as local media has come to know about and explore the role of the programme in the environments it serves, and as national media has come to view the approach as one that might be more broadly adopted. At the same time it has mobilized a level of scholar and teacher engagement that is testimony to far reaching effects on the environmental education and other sections of the curriculum, within which the project staff have collaborated with the Western Cape Education Department since the project's inception.

In these three ways the project has contributed substantially to several of the goals of the CBD's 2010 Biodiversity Target. Specifically, better understanding of species and their distributions in a little-studied group have been obtained (Goal 2), improved information on the value of protected areas for the conservation of biological diversity has been made available

(Goal 3), pressures from habitat degradation and invasive species have now been identified for this group (Goals 5 and 6), which are being used to inform policy, and new information on likely responses to climate change of a previously poorly investigated group has been generated (Goal 7). Finally, knowledge about the importance of biodiversity for delivering ecosystem services has been disseminated, so at least alerting those previously not aware of the importance of ecosystem services to their benefits. In so doing, an indirect contribution to Goal 8.2 has been made. In this respect, a considerable impact has been made on the way environmental and biodiversity science is being taught in the limbovane schools, so improving the experience of learners, their appreciation for the value of biodiversity, and the commitment of all involved to biodiversity conservation.

## **4.2 Outcomes: achievement of the project purpose and outcomes**

The project purpose was “*Ant diversity monitored in Western Cape (WC) & strengthened monitoring capacity and education at secondary school level in region*”. The project has certainly accomplished its purpose and achieved over and above its expectations for outcomes, especially in terms of capacity building. The project has involved more schools and trained many more teachers than anticipated and interacted with over 3400 learners, thereby building capacity in general science skills and in monitoring biodiversity in South Africa, which contributes directly to the project purpose. Regional curriculum advisers have also been trained, thereby raising the level at which the knowledge can be transferred. Buy-in from the Western Cape Education Department, schools and learners, and their enthusiasm for the project and the limbovane team is high and the future continuation of the project beyond the period of Darwin funding is secure. (See also 4.1).

Appreciation by local communities of the importance of biodiversity and ecosystem services and their long-term maintenance is a central outcome of the limbovane project. Poor, often rural, communities frequently have many other challenges to contend with on a day-to-day basis, rather than having to worry about biodiversity and ecosystem services. By teaching learners about their local environment and making this learning relevant to them, the limbovane project has stimulated an appreciation of the importance to society of biodiversity and environmental conditions. Additionally, interactions between learners and scientists and learning about the scientific method has stimulated learners to consider environmental science as a realistic career option. In consequence, local, regional and inter-regional activities aimed at improving sustainability of ecosystem services are likely to be far easier to implement because the rationale underlying them is better understood, as the general awareness of environmental issues is being raised.

The bi-annual workshops for participating teachers have had the additional benefit of promoting teacher and school networks across the Western Cape. Two learners from each school were also invited to one of the workshops at Stellenbosch University, which provided an opportunity for interactions between learners from different social backgrounds. For some, it also provided an opportunity to travel beyond their usual boundaries, and widen their social and cultural experiences. A small group of learners also visited the limbovane team at Stellenbosch University campus to gain a better understanding of the science behind the project. They experienced laboratory work in progress and also had the opportunity to discuss careers in science, one-to-one, with the limbovane team.

## **4.3 Outputs (and activities)**

### **OUTPUTS**

The limbovane project has achieved over and above its expectations for outputs.

#### **1. Biodiversity monitoring programme established & functioning in 10 schools**

The ant biodiversity monitoring programme has been established in 13, rather than the anticipated ten schools. Many of these are from previously disadvantaged areas. Schools were provided with two microscopes (one with a camera) to work with the specimens and the biology teacher with a notebook computer on which to display images as well as facilitating work with the lesson plans and data. Teachers and learners have participated enthusiastically, and the feedback has been excellent (see Annex 7 and Annex 10).



## **2. Trained teachers**

More teachers were trained than initially anticipated (32, rather than 10). This was largely due to two teachers (rather than one) from each school receiving training, but also partly due to teacher turn-over. However, teachers moving to other subjects or schools would have still gained much from their participation in the project that is transferable to other areas of the curriculum. In addition, enthusiasm from the WCED led to a request for training of nine regional curriculum advisers.

## **3. Baseline patterns of ant diversity established**

New baseline patterns of ant diversity in 15 pristine and 15 transformed sites, plus eight others, across the Western Cape have been established in a network of permanent monitoring plots, thereby making a key contribution towards establishing a national monitoring and inventorying programme for an important group of insects, which are also widely agreed to be excellent indicators of the effects of landscape change. The project provides data on the abundance and identity of ants for 33 assemblages over an area that covers some 3.5% of South Africa. Sites are located in two biomes of considerable global significance: the Fynbos and the Succulent Karoo. Basic site data have already been provided to the relevant protected area (national park and nature reserve) staff. After publication of scientific papers using data from the project, all of the project data will be made freely available.

## **4. Lessons learned & best practice disseminated**

Lessons learned are described in Section 5. Information about the project has been disseminated widely (see Section 5, Annex 5 and Annex 9), with attendance at more presentations and conferences than originally anticipated. A short paper outlining the project implementation and results has been published in the international journal *Bioscience*, and another, more extended, treatment of the outcomes and value of combining outreach and biodiversity inventorying and monitoring has been accepted by the *Journal of Insect Conservation*.

### **Additional outputs**

A major additional output from the project has been the production of a teaching manual (including lesson plans, worksheets and protocols, many of which are bi-lingual), so that the programme can be implemented more widely across the Western Cape, and perhaps even nationally. This is the culmination of the development of training materials that were produced during the life of the project.

Individual ant reference collections have been provided to each participating school. A combined reference collection has also been prepared and is held at Stellenbosch University. Voucher specimens will be deposited at Iziko Museums of Cape Town. [A photograph of part of the ant reference collection is shown in Annex 7]

A total of 33 permanent field plots have been established, in which monitoring will be continued for at least another five years.

## **ACTIVITIES**

### **1. Planning and training workshops.**

Project planning and evaluation workshops between project partners from the UK and South Africa have been held every year. These have proved to be very useful.

A total of six training workshops have been held for teachers from the schools involved. These have proved invaluable, with teachers learning how to implement the project, as well as helping to guide the development of lesson plans. They also received guidance on the possibilities of using the complete project data to perform other spatial and temporal comparisons and how to incorporate biodiversity information into other areas of the curriculum. An additional training workshop was held for Curriculum Advisers at the request of WCED. This covered project implementation, but also provided background to biodiversity and ant ecology, a practical session on how to sample ants and analyse biological data as well as covering theory on surveying and monitoring in ecology and the scientific method. This workshop ensured better



continuity within schools and the WCED and Curriculum Advisers are now better placed to assist teachers in the implementation of the limbovane project.

Two learners from each school, with their teachers, were invited to one of the workshops at Stellenbosch University, and were able to interact with limbovane learners from different environments while exploring the data in more detail. Through this workshop learners gained a better understanding of the scientific method, and were able to develop their public speaking skills during the presentations. The workshop included a fieldtrip which visited three of the schools and the control sites involved in the project, allowing learners and teachers to gain a better understanding of the differences between pristine and modified environments.

## **2. School visits; 3. Sampling and identification programme in collaboration with schools.**

Over the three-year period each of the participating schools has been visited between two and five times (depending on when they joined the programme). Visits have included lessons by project staff, field sampling with learners, and return visits to hand over data. Ant samples collected were returned to C•I•B for identification by project staff. Each school received reference collections of ants, image-based keys, and data sheets for their school and the nearby relatively untransformed areas. Some of these activities are illustrated in Annex 7.

## **4. Database establishment and population. Data analyses.**

The ant database set up at the start of the project has been populated with data on an ongoing basis, as information was extracted from the data collected during fieldwork. All of the data collected by the project, including ant species data and temperature/vegetation data have been entered and are available in a data management system at C•I•B. In addition, a database has been set up to store information relevant to the ant reference collections.

Data analyses have been ongoing at different levels. At a simple level, learners have been able to explore the data and relate them to the site maps and vegetation data and temperature data that were collected at the same time as the ant sampling. Project scientists have also been analysing the complete data sets in various ways; scientific publications have been submitted, or are in preparation.

## **5. Electronic, image-based keys for identification of ants developed and tested.**

Simple electronic, image-based keys that could be used by teachers and learners were produced early on in the project. These have been refined into one comprehensive key to the species encountered over the life of the project.

## **6. Publicity material (reports, press releases, scientific papers)**

The main form of dissemination and communication has been through presentations at various international and national conferences and local forums (Annex 9), together with publications (Annex 5) and a dedicated website ([www.sun.ac.za/iimbovane](http://www.sun.ac.za/iimbovane)). A pamphlet about the project was produced and used to promote the project at various public events such as conferences and Expos. Engagement with interested journalists has been fruitful. See also Section 5.

The main issue of concern within all schools is the high teacher turnover. This turnover does not necessarily see teachers leaving schools, but rather being assigned to teach different subjects within the same school. However, by continuing to offer regular training workshops much of this concern has been alleviated. At many schools a single teacher was identified as the contact for the limbovane project. This means that although the teacher may not necessarily be involved with the Grade 10 learners in consecutive years, they are aware of the project and co-ordinate activities for the project within their schools. Additionally, we have found that once teachers are trained they remain active in the project, even though they are required to teach other subjects.

It became evident after the first main sampling season that a significant rate-limiting step to the development of the project was in the preparation and identification of the ant samples. This challenge remains and will require careful management as expansion is considered.

One of the laptop computers provided to one of the schools by the project was stolen. As the conditions set out in the Memorandum of Understanding were not met by the school in terms of securing the laptop, Stellenbosch University's insurance would not cover the cost of the stolen

laptop. Additional steps were subsequently taken at all schools to ensure laptops are better secured in the future.

#### **4.4 Project standard measures and publications**

*See Annex 4 and Annex 5*

#### **4.5 Technical and Scientific achievements and co-operation**

Research staff involved on the UK side were the PI (K.J. Gaston), and full-time post-doctoral scientist (B. Braschler), with administrative support from S.Shaw and additional assistance from M. Parnell, N. Lerner and L. Cantú-Salazar.

From the host country, a variety of staff has been involved in the project, including the PI (S.L. Chown), project manager (K. Mahood), project technician (N. Karenyi neé Kruger), additional technical assistance during field trips (T. Khoza, K.R. Jumbam, C. Kassier, E. Nortje, S. Kritzinger-Klopper), volunteers during field work, and services from the C-I-B Database Manager (K. Coombe-Davis) and Deputy-Director: Operations (S.J. Davies).

A summary of methods and results is given in Annex 8.

Two scientific papers have been submitted / accepted for publication in international, peer-reviewed journals. Two further papers are in preparation.

#### **4.6 Capacity building**

This project addresses the problem of teacher capacity within the field of biodiversity, while simultaneously addressing the issue of a lack of biodiversity knowledge within the Cape Floristic Region. It does so in several ways. First, it has provided expert training to project staff on ant identifications, which will ensure effective ongoing work in the project. This knowledge was transferred by the UK post-doctoral associate to project technical staff in South Africa. Second, it has improved the ability of over 30 teachers and nine curriculum advisors to provide relevant and thoughtful instruction in areas of the curriculum that were previously challenging, but nonetheless identified as significant. Through this instruction it has contributed directly to the education of over 3400 learners. Moreover, project staff have been involved with the provision of further advice on implementation of the curriculum to curriculum advisors from across South Africa. Third, students working for the City of Cape Town continue to assist with fieldwork when they are available.

The limbovane project is achieving over and above its agreed outcomes in capacity building. In two years the limbovane project has trained more teachers than anticipated and interacted with over 3400 learners, thereby building capacity in general science skills and in monitoring biodiversity in South Africa, which contributes directly to the project purpose. Buy-in from the schools and their enthusiasm for the project and the limbovane team remains high, showing that the assumption of continued enthusiasm of teachers and learners in the participating schools holds true.

Evidence for increasing interest and capacity in biodiversity can be seen in the increased numbers of teachers, curriculum advisers and learners trained in project implementation as well as other biodiversity topics. We are particularly pleased that enthusiastic learners have themselves presented posters and given oral presentations based on their findings, which is a clear demonstration that learners are interested in and enjoying the limbovane project and are incorporating it into their school work and extracurricular activities. In addition, limbovane pitfall samples are now being passed on to SANSA for analysis of arachnids (section 2). This partnership will provide a huge boost to the biodiversity knowledge of the Western Cape and will produce excellent opportunities for further research and collaboration.

Continuous training of teachers in both project implementation and additional topics related to biodiversity provides WCED with potential lead teachers that are able to assist new teachers to implement the project, ensuring a sustained capacity building impact. The worksheets and lesson plans developed by the project, especially those that were developed in January 2008, will enhance the implementation process, as there is now a standard learner assessment

activity for the project. Moreover, a full manual for the project has now been completed, is being printed, and will be issued to schools in 2009.

The UK lead institution provided a full-time research scientist to work with project staff in South Africa. It quickly became evident that it would be more effective in providing support to the project for her to remain in the host country for longer periods than originally planned in order to participate more fully in the sampling programme and work on the ant collections, including identification, training and preparation of an ant identification key, so this was arranged. Dr Braschler rapidly became an expert on the local ants, and was able to train other project staff in their identification, and prepare the image-based identification keys for use in schools. By spending more time in the host country than anticipated she was also able to develop her skills in other directions, including in teaching.

#### **4.7 Sustainability and Legacy**

The infectious enthusiasm for the project from staff, participants (teachers and learners) and partners, and the data generated will ensure the continuation of the outputs, outcomes and impacts (see Sections 4.1–4.6) in the longer term.

The host country partner (C-I-B) has committed to support this work for at least another 5 years – limbovane will become its flagship outreach project. This will guarantee funds to allow participation of the 13 schools already involved. A business plan has been developed and funding from external sponsors is actively being sought. Moreover, the aim is that the monitoring programme will eventually be absorbed into the overall framework of biodiversity monitoring in South Africa that will be developed as part of the National Environmental Management: Biodiversity Act through the SANBI. The data collected as part of this project will be made permanently available via the South African Biodiversity Information Facility and SAEON, thus contributing a legacy of biodiversity data.

Involvement in the project has certainly contributed to increasing an interest in science as a career in at least some learners (see quotes in Annex 10).

All equipment donated to schools will remain with them. The microscope/camera bought for the project will remain at C-I-B and be used in the next phase of the project.

Close ties have continued to develop between the two partner institutions, and the UK project leader has recently been re-appointed an “Extraordinary Professor” at the University of Stellenbosch for another three years, which will ensure future liaison. In addition, the UK project scientist, Dr Braschler, has been appointed by the C-I-B as a post-doctoral research fellow to further contribute to research on ants and climate change. She will therefore be on hand to collaborate on further publications stemming from the project and to advise as the project continues and expands in the future.

Two of the limbovane staff in South Africa (Ms Mahood and Ms Karenji) have left the C-I-B, but remain in the biodiversity field. Two new research staff members (K. Jumbam, C. Muofhe) have already been appointed, as has a new manager for the project (D. du Plessis). They will implement the new phase of the project with C-I-B support.

*See also Section 5 – lessons learned*

### **5 Lessons learned, dissemination and communication**

The key lessons to be drawn from the experience of the project are as follows:

- It is possible to successfully combine scientifically rigorous monitoring of ants with participation and education at secondary school level. In addition to contributing to data collection, through direct contact with scientific staff and involvement in an interesting and engaging project in their own back yard, learners quickly understand that ‘biodiversity’ is of direct relevance to them and their local environment, and not just reserved for pristine areas or those supporting rare animals in other parts of the country or even of the globe. They can see directly some of the human impacts (refuse, disturbance, destruction etc) on their local environment and then better understand some of the global issues about which they read or are taught.

- The skills gained by teachers and learners are transferable well beyond the scope of the project, and into other areas of the curriculum. These skills include the principles of good experimental design, sampling and surveying techniques, use of microscopes, use of keys, image and data handling, analysis and presentation, and management of data collection.
- The dual approach of combining scientific study / monitoring with education / outreach means real integration of an appreciation of biodiversity and knowledge of how to assess it, as well as increased awareness of environmental issues and the world of science into the daily lives of people not routinely exposed to such matters.
- One of the biggest lessons learned during the first six months of the project was the importance of acceptance by host country project collaborators, such as WCED, to ensure project success. It was important that WCED accept the project before approaching individual schools and teachers. Teacher selection has also been vital to the success of the project. Guidance from WCED was essential to select teachers who were most likely to promote and accept the limbovane project within their schools.

The main form of dissemination and communication has been through presentations at various international and national conferences and local forums (Annex 9), together with publications (Annex 5) and a dedicated website ([www.sun.ac.za/iimbovane](http://www.sun.ac.za/iimbovane)). A pamphlet about the project was produced and used to promote the project at various public events such as conferences and expos. Engagement with interested journalists has been fruitful.

Two press releases were issued in the UK. The latest (15<sup>th</sup> December 2008) resulted in the publication of four articles on websites and one printed press article.

Presentations to a primarily scientific / academic audience have included for example,

- the Society for Conservation Biology conference (South Africa, July 2007): Dr Braschler presented preliminary findings on ant distribution patterns in the Cape Floristic Region.
- the annual meeting of the British Ecological Society (London, Sept 2008): Dr Braschler presented a paper examining ant diversity patterns and how environmental factors and disturbance influence ant diversity, comparing the ant diversity of this plant diversity hotspot (the Cape Floristic Region) to that of a range of ecosystems worldwide.

Presentations to an audience more interested in the educational aspects of the project included:

- IV World Environmental Education Congress (2007): Ms Mahood presented limbovane as a novel way of implementing schools-based outreach activity in environmental education.
- The national Fynbos Forum Meeting (2007): Ms Mahood presented the educational outcomes of the project in terms of the advantages for learners and teachers.
- The South African Association of Science and Technology Educators (SAASTE) Mini-Conference in Cape Town (September 2007): Ms. Mahood and Ms. Kruger gave a joint presentation at this interactive session, aimed at teachers, and demonstrated how biological data can be used in the Information and Communication Technology Classroom.
- At the Ecological Society of America conference (Aug 2008) Ms Mahood co-hosted a session "Projects Linking Science Research and the Community" with the USA-based Discover Life's "Ant Hunt!" project.

Talks have also been given to local community groups, for example, in September 2007, Ms. Kruger presented an outline of the limbovane project to the Ward Council meeting for the Kraaifontein suburb of the City of Cape Town.

The limbovane project was involved in three youth symposia during 2007 (see 3<sup>rd</sup> Annual Report for details). In addition, learners from participating schools have prepared posters and given presentations (including one to a delegation from the British Council (including Sir David King)), which resulted in the British Council sponsoring them to attend the National Science Festival "SciFest" at Grahamstown in 2008.

A school in London twinned with one of the limbovane schools was contacted in October 2008 with details about the project, and a visit offered, but there has been no response to date.

Information about the project has also been sent out to several web-based organisations. One, “Green Teacher” ([www.greenteacher.com](http://www.greenteacher.com)), based in Canada/USA, has expressed interest in including details about limbovane in a composite article about enviro-education initiatives currently underway in South Africa.

Dissemination will certainly continue and develop after the completion of the project (see Section 4.7).

## 5.1 Darwin identity

Information about the project and results from it have been disseminated widely (see Annex 5 and Annex 9), and every opportunity was taken to use the Darwin logo, acknowledge Darwin funding and to explain the background to the Darwin Initiative. All material used and produced by the project has carried the Darwin logo and name. Vehicles used for the project as well as any hardware (microscopes, pcs) have carried the Darwin logo together with that of the C-I-B. The Darwin name has been used in the acknowledgments in all publications, and the logo and name has been used in all presentations. Darwin publicity materials have been given out to teachers and learners, and were presented to participants at the final project hand-over event (although we were disappointed that not all of the materials we requested for this were available). The project has a dedicated web site hosted by C-I-B, which has links to the Defra Darwin web site.

The project is recognised as distinct within South Africa, with a clear identity even though there are links to other programmes.

We are confident that WCED, curriculum advisers and teachers, as well as learners involved, are familiar with the Darwin Initiative. In fact familiarity may have spread further than anticipated as we were surprised to find that the Darwin vehicle sticker was stolen from one of the vehicles when out in the field on a sampling visit!

## 6 Monitoring and evaluation

No major changes have been made to the project design with the exception of some rescheduling of workshops better to suit the timing of events, and at the request of the teachers involved in the project. The project was also extended by three months to facilitate production of outputs and publicity. Some minor changes were made to the allocation of finances between years and between budget headings, but without incurring additional costs.

We found the system of regular reporting against agreed annual targets for activities and outputs to be a useful way of monitoring how the project was progressing. This formed the focus of the annual meetings between project partners, and provided the basis for discussion of progress and future plans. Host country partners have provided useful feedback on project progress to the WCED and other interested parties; progress reports have been submitted to CapeNature as well as several national parks and managers of eleven reserves and farms. The logframe indicators (see Annex 2) were also considered to be useful and appropriate.

The project sampling programme was set up to monitor ant biodiversity across the Western Cape, and therefore the first sampling occasion provided the necessary baseline scientific data.

The project was evaluated annually by the C-I-B Board as part of the annual reporting of the Centre to its Board and to its major funders (the Department of Science and Technology and the National Research Foundation). The Board was uniformly enthusiastic about the project and has been highly complementary of the project's outcomes. For example, in 2006, one of the Board members said: *'Prof Skelton informed the Board that the SAIAB outreach personnel had visited the limbovane project team and found several lessons to apply in the SAIAB outreach programme. The programme appeared to be very successful and SAIAB was excited about it and is applying some of the lessons learnt in its education programmes in the aquatic biology field.'* Board members have on several occasions indicated that the project is very much the epitome of a successful outreach project that delivers real results to learners and teachers.

Ms. K. Mahood was awarded the Stellenbosch University Rector's Award for Excellence in Community Interaction on the basis of her work in this project, representing a resounding endorsement of the project and Ms. Mahood's skills.

As part of the C-I-B's mid-term review, the limbovane project will be evaluated in early 2009.

WCED does not give the limbovane project a formal evaluation. However, the impact that the project has had within the WCED is evident in the continuous requests from WCED to the limbovane project to expand the project to include every school within the WCP, as well as the request for specific training of curriculum advisers. In a letter of thanks received by the limbovane team from the WCED at the end of 2007, the WCED states that "*Your energy, enthusiasm and knowledge of your subject are invaluable to our teachers and learners.*" The limbovane team are looking for ways to expand the project to include all schools within the Western Cape, although there are still currently a number of constraints that would have to be overcome.

## 6.1 Actions taken in response to annual report reviews

All of our reviews have been excellent, and have been disseminated and discussed with partners and other collaborators. None of the annual reviews have raised issues that needed our response.

## 7 Finance and administration

### 7.1 Project expenditure

Description	Budget Original	Budget Final	Expenditure Claim Forms	Balance
Staff Costs				
Overheads				
Postage / Office				
Travel & Subsistence				
Printing				
Conferences				
Capital Items				
Others				
<b>Total</b>				

There were variations to the original budget in each category as the project progressed but the overall budget remained the same. All changes were agreed with the Darwin Secretariat. Capital items provided to participating schools were primarily laptop computers, microscopes and cameras. The apparently large (in percentage terms) underspend in Printing costs (c. £300) was largely due to some costs in Year 3 having been charged to the Postage /Office costs budget, which was reported at the time.

### 7.2 Additional funds or in-kind contributions secured

As anticipated in the original project document, a total of over £140,000 was secured in additional funding. A charitable donation was received in addition to contributed costs from the host country partner.

*Partner investment: Stellenbosch University*

---

	Apr 05-Mar 06	Apr 06-Mar 07	Apr 07-Mar 08	Apr 08-Sept 08
Personnel costs				
Support from SU (floor space and services)				
Disbursements:				
Office costs (phone, internet)				
Travel & Subsistence				
Running costs				
<b>Total</b>				

---

*Donation: May and Stanley Smith Charity*

### **7.3 Value of DI funding**

This funding has been the backbone of the limbovane project. Without it, schools would not have had access to microscopes or computers. Improved teaching within the curriculum would not have been possible and the project would have amounted to little more than a set of information provision sessions, which are often ineffectual. The funding also enabled the UK post-doc and PI to provide training in ant identification and sampling techniques that otherwise would not have been readily obtainable by project staff.



## Annex 1 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements	Actions planned for the future
<p><b>Goal:</b> To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but constrained in resources to achieve</p> <ul style="list-style-type: none"> <li>• The conservation of biological diversity,</li> <li>• The sustainable use of its components, and</li> <li>• The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources</li> </ul>		<p>The project has successfully combined scientifically rigorous monitoring of ants with participation and education at secondary school level to provide new information on ant diversity patterns over large spatial and temporal scales, and investigate land-use and climate change impacts. The dual approach means real integration of an appreciation of biodiversity and knowledge of how to assess it, as well as increased awareness of environmental issues and the world of science in the daily lives of people not routinely exposed to such matters.</p>	<p><i>(do not fill not applicable)</i></p>
<p><b>Purpose</b></p> <p>Ant diversity monitored in Western Cape (WC) &amp; strengthened monitoring capacity and education at secondary school level in region</p>	<p>New knowledge on dynamics of ant diversity in WC</p> <p>Biodiversity monitoring scheme functioning by yr 3</p> <p>Improved understanding of biodiversity amongst learners</p>	<p>In total, over 3000 learners, 32 teachers and 9 Curriculum Advisers received training on biodiversity monitoring; simultaneously an ant monitoring programme has been established across the WC and sampling has taken place five times from natural and transformed sites. Thus new knowledge of ant diversity across the WC has been established. Educational resources, including ant reference collections, databases and a training manual have been produced. These outcomes contribute directly to ensuring that the purpose of the project is achieved.</p>	<p>The host country partner (C••B) has confirmed continued funding to ensure that the monitoring and education programme continues with existing schools. Funding is actively being sought to expand the programme into more schools.</p> <p>The data collected as part of this project will be made permanently available via SABIF and SAEON, thus contributing a legacy of biodiversity data.</p>
<p><b>Output 1.</b> Biodiversity monitoring programme established &amp; functioning in 10 schools</p>	<p>Participation by schools and take up of keys</p>	<p>The biodiversity monitoring programme is active in 13 schools in the WC, and will continue. Participation within schools has been outstanding and enthusiastic. All schools have received the image-based identification keys and other resources which have been used within the classroom both in directly-related lessons and extended to other areas of the curriculum. The indicator is appropriate.</p>	

Activity 1.1 Sampling and identification programme		Sampling is undertaken in October and March each year. Identification was undertaken by project staff, and the data returned to the schools. Ant reference collections (including a full collection and one for each school) have been prepared. Voucher specimens will be deposited at Iziko Museums of Cape Town.
<b>Output 2.</b> Trained teachers	Minimum of 10 staff trained by yr 3 in ant biodiversity assessment	In total, 32 teachers have been trained, of which 27 are from previously disadvantaged communities. The indicator is appropriate.
Activity 2.1. Workshops		A total of 6 training workshops have been hosted by project staff. Annual workshops for UK and host country staff have taken place. 9 WCED Curriculum Advisers attended an implementation training workshop, which was unscheduled. The handover workshop and celebration event took place in September 2008.
<b>Output 3.</b> Baseline patterns of ant diversity established	2 papers submitted to international scientific journals by end of yr 3	New baseline patterns of ant diversity in 13 pristine and 13 transformed sites, plus 8 others, across the WC have been established in a network of permanent monitoring plots. Data analysis is ongoing. Preliminary findings have been presented at conferences; one paper has been accepted, one submitted, and two others are now in preparation. The indicators remain appropriate.
Activity 3.1. Sampling and identification programme		See above for Activity 1.1.
Activity 3.2. Data analyses		See above for Output 3
Output 4. Lessons learned & best practice disseminated	Minimum of 1 radio broadcast, 2 popular articles published	Information dissemination about the project has been ongoing throughout the period, including presentations and various publications as well as national TV and radio interviews. At the Ecological Society of America conference (Milwaukee, Wisconsin, Aug. 2008) Ms Mahood co-hosted a session with the USA-based Discover Life's "Ant Hunt!" project (see Section 3), entitled "Projects Linking Science Research and the Community", which covered best practice in outreach and ecological research projects and methods to ensure that both science or community interaction goals are reached and maximised. Contact was made with researchers in the US who are very interested in working with the limbovane, which is a major advance for the project in terms of awareness of the project outside of South Africa. There is also now excellent potential for interactions with a broad range of researchers in the next phase of the project.
Activity 4.1. Publicity material		A pamphlet about the project has been produced and used to promote the project at various public events such as conferences and Expos. For the full list of publicity see Annex 5. Engagement with interested journalists is continuing.

## Annex 2 Project's final logframe, including criteria and indicators

### Annex 1a: Original Logical Framework

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<b>Goal:</b> <b>To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve</b> <ul style="list-style-type: none"> <li>• the conservation of biological diversity,</li> <li>• the sustainable use of its components, and</li> <li>• the fair and equitable sharing of benefits arising out of the utilisation of genetic resources</li> </ul>			
<b>Purpose</b>  Ant diversity monitored in Western Cape (WC) & strengthened monitoring capacity and education at secondary school level in region	New knowledge on dynamics of ant diversity in WC  Biodiversity monitoring scheme functioning by yr 3  Improved understanding of biodiversity amongst learners	South African partner institutional reports  Peer-reviewed publications by project partners	Schools agreement and participation  Continued enthusiasm of teachers & learners
<b>Outputs</b>  Biodiversity monitoring programme established & functioning in 10 schools  Trained teachers  Baseline patterns of ant diversity established  Lessons learned & best practice disseminated	Participation by schools and take up of keys  Minimum of 10 staff trained by yr 3 in ant biodiversity assessment  2 papers published in international scientific journals by end of yr 3  Minimum of 1 radio broadcast, 2 popular articles published	Reports from schools to WC Education Department  Reports from schools to WC Education Department  Copies of publications sent to Darwin Initiative  Copies of all publications & recordings sent to Darwin Initiative	Ongoing availability of taxonomic expertise  Trained staff remain in participating schools  N/A  N/A

<b>Activities</b>	<b>Activity Milestones (Summary of Project Implementation Timetable)</b>
Workshops	<p>Yr 1: Planning workshop with project team to establish project, conduct detailed planning &amp; coordination; Yr 1: Teacher information workshop; Yr 2: Teacher training workshop on sampling and implementation; Yr 2: Schools implementation visits; Yr 2: Progress &amp; planning workshop with project team &amp; stakeholders; Yr 3: Progress &amp; planning workshop with project team &amp; stakeholders; Yr 3: Second teacher information workshop; Yr 3: Teacher training workshop on interactions; Yr 3: Schools implementation and follow on visits</p>
Sampling and identification programme	<p>Yr 1: Major transects established by project staff, sampled &amp; data extracted; Yr 1: Schools identified and participation agreed; Yr 1-3: School sampling established, samples sorted &amp; data extracted; Yr 2-3: Continued sampling of transects &amp; data extraction; Yr 2-3: electronic, image-based keys developed and tested; Yr 3: Monitoring programme and inter-school contacts established</p>
Data analyses	<p>Yr 1: Database system established and populated with test data; Yr 2-3: Database populated; data from sampling analysed; Yr 3: Analyses written up</p>
Publicity material	<p>Yr 1: 2 press releases, 1 radio broadcast; Yr 2: 2 popular articles, 2 press releases; Yr 3: 2 press releases and television coverage solicited, 2 papers submitted to international scientific journals</p>

## Annex 3 Project contribution to Articles under the CBD

Article No./Title	Project %	Article Description
6. General Measures for Conservation & Sustainable Use		Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring	35%	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
8. In-situ Conservation	15%	Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
9. Ex-situ Conservation		Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity		Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures		Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	35%	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
13. Public Education and Awareness		Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
14. Impact Assessment and Minimizing Adverse Impacts		Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
15. Access to Genetic Resources		Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.
16. Access to and Transfer of		Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair

Article No./Title	Project %	Article Description
Technology		and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
17. Exchange of Information		Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol		Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Other Contribution	15%	Smaller contributions (eg of 5%) or less should be summed and included here.
Total %	100%	Check % = total 100

## Annex 4 Standard Measures

Code	Description	Totals (plus additional detail as required)
<b>Training Measures</b>		
4a	Number of undergraduate students receiving training	2 undergraduate students received on-the-job training in ant identification
4b	Number of training weeks provided to undergraduate students	14
4c	Number of postgraduate students receiving training (not 1-3 above)	1 (Masters student)
4d	Number of training weeks for postgraduate students	
6a	Number of people receiving other forms of short-term education/training (ie not categories 1-5 above)	
6b	Number of training weeks not leading to formal qualification	
7	Number of training materials produced for use by host country(s)	15 (incl. worksheets, posters, leaflets and manual)
<b>Research Measures</b>		
8	Number of weeks spent by UK project staff on project work in host country(s)	108
10	Number of formal documents produced to assist work related to species identification, classification and recording.	1 (image-based key to ants)
11a	Number of papers published or accepted for publication in peer reviewed journals	1
	Number of papers submitted for publication in peer reviewed journals	2
11b	Number of papers published or accepted for publication elsewhere	0
	Number of papers submitted for publication elsewhere	0
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	2
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	
13a	Number of species reference collections established and handed over to host country(s)	1 (plus 13 collections for individual schools)
13b	Number of species reference collections enhanced and handed over to host country(s)	none



Code	Description	Totals (plus additional detail as required)
<b>Dissemination Measures</b>		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	6 (teacher information and training workshops) over a total of 2 weeks and involving a total of 9 curriculum advisers, 32 teachers and 20 learners. Over 3400 learners were reached during a total of 75 days spent in schools by project staff. Final hand-over event organised for 75 people.
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work have been presented/ disseminated.	10
15a/b	Number of national press releases or publicity articles in host country(s)	20 Local/National articles in SA (including websites) +
15c	Number of national press releases or publicity articles in UK	2 press releases + 2 articles
15d	Number of local press releases or publicity articles in UK	2 articles
16a	Number of issues of newsletters produced in the host country(s)	1
16b	Estimated circulation of each newsletter in the host country(s)	75
16c	Estimated circulation of each newsletter in the UK	3
17a	Number of dissemination networks established	1
17b	Number of dissemination networks enhanced or extended	
18a	Number of national TV programmes/features in host country(s)	2 (National TV Interviews in SA)
18b	Number of national TV programme/features in the UK	
18c	Number of local TV programme/features in host country	1
18d	Number of local TV programme features in the UK	
19a	Number of national radio interviews/features in host country(s)	4 (National radio interviews in SA)
19b	Number of national radio interviews/features in the UK	
19c	Number of local radio interviews/features in host country (s)	
19d	Number of local radio interviews/features in the UK	

Code	Description	Totals (plus additional detail as required)
<b>Physical Measures</b>		
20	Estimated value (£s) of physical assets handed over to host country(s)	£33,110 (computers, microscopes, sampling equipment etc)
22	Number of permanent field plots established	33 monitoring plots
23	Value of additional resources raised for project	> £140,000
<b>Other Measures used by the project and not currently including in DI standard measures</b>		
	<i>Not applicable</i>	

## Annex 5 Publications and other publicity materials

### Year 1 (2005–6):

Type	Detail	Publishers	Available from	Cost £
Programme for the SAEON Summit	<i>Extra-curricular high school science education programmes and monitoring</i> B.A. Damonse, K. Mahood & S. Makoena 2006	SEAON Summit, Pretoria	<a href="http://www.saeon.ac.za/su/mmit/SAEONSummit2006PaperAbstracts.pdf">http://www.saeon.ac.za/su/mmit/SAEONSummit2006PaperAbstracts.pdf</a>	Free
Programme for the SAEON Summit	<i>limbovane: Exploring South African biodiversity and change</i> B. Braschler, K. Mahood, S.L. Chown, N. Kruger and K.J. Gaston 2006	SEAON Summit, Pretoria	<a href="http://www.saeon.ac.za/su/mmit/SAEONSummit2006PaperAbstracts.pdf">http://www.saeon.ac.za/su/mmit/SAEONSummit2006PaperAbstracts.pdf</a>	Free
Newspaper	<i>Pupils project puts ants in their pants.</i> J. Yeld, December 2005.	Cape Argus, Cape Town	<a href="http://www.capeargus.co.za/index.php?fSectionId=49&amp;fArticleId=3041364">http://www.capeargus.co.za/index.php?fSectionId=49&amp;fArticleId=3041364</a>	Free
Newspaper	<i>Jonges het miere.</i> (English = Youth have ants) E. Duvenage, January 2006.	Paarl Post, Paarl (community newspaper)	Scanned copy available from host country limbovane office	Free
Newspaper	Picture of teachers on the training workshop with a caption February 2006	Paarl Post, Paarl	Scanned copy available from host country limbovane office	Free
Website	Promotion for future show for the "Groen" television show (February 2006)	Homebrew Films, Cape Town	<a href="http://www.groen.co.za/news_february.htm">http://www.groen.co.za/news_february.htm</a>	Free
University of Stellenbosch website for the Science Faculty newsletter	<i>C•B uses ants to teach biodiversity basics.</i> Engela Duvenage January 2006	Stellenbosch University, Stellenbosch	<a href="http://www.sun.ac.za/News/NewsItem_Eng.asp?Lang=2&amp;ItemID=9316&amp;Zone=AE">http://www.sun.ac.za/News/NewsItem_Eng.asp?Lang=2&amp;ItemID=9316&amp;Zone=AE</a> X and <a href="http://academic.sun.ac.za/science/n_ewsstudents.htm">http://academic.sun.ac.za/science/n_ewsstudents.htm</a>	Free

### Year 2: (2006–7)

Type	Detail	Publishers	Available from	Cost £
Promotional material	<i>Centre of Excellence a welcome threat to invasive species.</i> K. Mahood. 2006.	Stellenbosch University, Stellenbosch, South Africa	Stellenbosch University Research Office ( <a href="http://www.sun.ac.za">www.sun.ac.za</a> )	Free
Conference proceedings	<i>Working with education: The limbovane outreach project.</i> K. Mahood, N. Kruger, B. Braschler, S.L. Chown, K.J. Gaston. 2006	South African Agency for Science and Technology Advancement, Pretoria, South Africa	South African Agency for Science and Technology Advancement ( <a href="http://www.saasta.ac.za">www.saasta.ac.za</a> )	Free
Newspaper article	<i>Schools equipped for ant hunt.</i> E. Duvenage. 2006	Paarl Post, Paarl, South Africa	Publisher based in Paarl	£0.50
Newspaper	<i>Equipment for schools involved with ant project.</i> University of Stellenbosch Media Office. 2006	Stellenbosch University, Stellenbosch, South Africa	Stellenbosch University Media Office ( <a href="http://www.sun.ac.za">www.sun.ac.za</a> )	Free
Newsletter	<i>Equipment for schools involved with ant project.</i> E. Duvenage. 2006	Stellenbosch University, Stellenbosch, South Africa	Stellenbosch University Media Office ( <a href="http://www.sun.ac.za">www.sun.ac.za</a> )	Free
Newsletter	<i>Learners explore ant diversity in the Western Cape.</i> B. Braschler. 2006.	Addo Elephant Park, South Africa	Addo Elephant Park ( <a href="http://www.sanparks.org">www.sanparks.org</a> )	Free

Type	Detail	Publishers	Available from	Cost £
Newspaper	<i>Wetenskapleerders het miere danksy Maties.</i> E. Duvenage. 2007	Suid-Kaap Forum, Riversdale, South Africa	Suid-Kaap Forum	£0.50
Newspaper	<i>Ants in her jam sandwich makes this girl smile!</i> E. Duvenage. 2007.	District Mail, Somerset West, South Africa.	District Mail	£0.50
Newspaper Cartoon	Cartoon showing learners looking at ants, with a caption on the limbovane project. Anon. 2007.	District Mail, Somerset West, South Africa.	District Mail	£0.50
Newsletter	<i>Microscopes for all to see.</i> Mahood, K. 2006.	Ellerman Resource Centre, South Africa	Ellerman Resource Centre ( <a href="http://www.sun.ac.za/erc">www.sun.ac.za/erc</a> )	Free
Newsletter	<i>limbovane distribution expanding.</i> N. Kruger. 2006.	Ellerman Resource Centre, South Africa	Ellerman Resource Centre ( <a href="http://www.sun.ac.za/erc">www.sun.ac.za/erc</a> )	Free
Newsletter	<i>Calculating Biodiversity.</i> N. Kruger. 2006.	Ellerman Resource Centre, South Africa	Ellerman Resource Centre ( <a href="http://www.sun.ac.za/erc">www.sun.ac.za/erc</a> )	Free
Newsletter	<i>Opening of Ikamvalethu Secondary School.</i> N. Kruger. 2006.	Ellerman Resource Centre, South Africa	Ellerman Resource Centre ( <a href="http://www.sun.ac.za/erc">www.sun.ac.za/erc</a> )	Free
Newsletter	<i>International exposure for limbovane.</i> N. Kruger. 2007.	Ellerman Resource Centre, South Africa	Ellerman Resource Centre ( <a href="http://www.sun.ac.za/erc">www.sun.ac.za/erc</a> )	Free
Newsletter	<i>limbovane expanding.</i> N. Kruger. 2007	Ellerman Resource Centre, South Africa	Ellerman Resource Centre ( <a href="http://www.sun.ac.za/erc">www.sun.ac.za/erc</a> )	Free

### Year 3 (2007–8):

Type	Detail	Publishers	Available from	Cost £
Pamphlet	limbovane pamphlet. K. Mahood, N. Kruger, B. Braschler, S.L. Chown, K.J. Gaston. 2007	C-I-B, Stellenbosch, South Africa	limbovane project office at Stellenbosch University, Private Bag X1, Matieland, 7602	Free
Magazine article	Eyewitness: Franco Eagleton. March 2007.	New Media Publishing (Pty) Ltd., Cape Town, South Africa	New Media Publishing (Pty) Ltd., Cape Town, Tel: +27 (21) 417 1111 or <a href="http://www.newmediapub.co.za">www.newmediapub.co.za</a>	£9.00 for subscription to receive 8 editions of magazine (issues not sold individually)
Magazine article	Eyewitness: Franco Eagleton March 2008 Account of limbovane workshop in Jan 2008	Hip 2B2; New Media Publishing (Pty) Ltd., Cape Town, South Africa	New Media Publishing (Pty) Ltd., Cape Town, Tel: +27 (21) 417 1111 or <a href="http://www.newmediapub.co.za">www.newmediapub.co.za</a>	£9.00 for subscription to receive 8 editions of magazine (issues not sold individually)

Type	Detail	Publishers	Available from	Cost £
Thematic Review	<i>Communication, Education and Public Awareness. Thematic Review.</i> Ian Edwards, Kirsti Thornber, Stephanie Walker, Rob Wild, March 2007. [Mentions the limbovane project several times and gives details as Case Study 4.]	ECTF and Darwin Initiative, UK	<a href="http://darwin.defra.gov.uk/reports/thematic_review.CEPA.pdf">http://darwin.defra.gov.uk/reports/thematic_review.CEPA.pdf</a>	Free
Newsletter article	Darwin Initiative Newsletter. Issue 10, Dec. 2007, p3. <i>limbovane Outreach Project: Exploring South African Biodiversity and Change.</i> [Gives details of limbovane outstanding achievements, as given in project Annual Report No. 2 (April 07)]	ECTF and Darwin Initiative, UK	<a href="http://darwin.defra.gov.uk/newsletter/DARWIN_NEWS_10.pdf">http://darwin.defra.gov.uk/newsletter/DARWIN_NEWS_10.pdf</a>	Free
Newspaper article	<i>Personeellede oor breë spektrum vir voortreflikheid beloon.</i> Anonymous 2007.	Stellenbosch University Kampusnuus, Stellenbosch, South Africa	Stellenbosch University, Private Bag X1, Matieland, 7602	Free
Programme/abstract	<i>Ant diversity patterns in the Cape Floristic Region.</i> B. Braschler, K. Mahood, N. Kruger, K.J. Gaston, S.L. Chown. 2007	Society for Conservation Biology	<a href="http://www.nmmu.ac.za/scb/ctalks.htm">http://www.nmmu.ac.za/scb/ctalks.htm</a>	Free
Abstract	<i>limbovane: it's about the learners.</i> K. Mahood, B. Braschler, N. Kruger, K.J. Gaston, S.L. Chown. 2007	Fynbos Forum, Cape Town, South Africa	Botanical Society, Tel: +27 21-799 8824 Email: <a href="mailto:paisley@botanicalsociety.org.za">paisley@botanicalsociety.org.za</a> Website: <a href="http://www.botanicalsociety.org.za/">http://www.botanicalsociety.org.za/</a>	Free

#### Year 4 (2008–9):

Type	Detail	Publishers	Available from	Cost £
Journal article	Braschler, B. (2009) <i>Viewpoint: Citizen scientist monitoring in a resource-poor country.</i> BioScience, February 2009, Vol. 59 No. 2 pp 103-104	BioScience	<a href="http://www.aibs.org/bioscience/">http://www.aibs.org/bioscience/</a> ; February 2009, Vol. 59 No. 2 pp 103-104	USD70/year (individual subscription) or USD25.00 per download (average)
Journal article	Braschler, B., Mahood, K., Karenzi, N., Gaston, K.J. and Chown, S.L. <i>Realizing a synergy between research and education: How participation in ant monitoring helps raise biodiversity awareness in a resource-poor country.</i> Journal of Insect Conservation. [Accepted Feb. 09]	SpringerLink	See <a href="http://www.springerlink.com/content/100177/">http://www.springerlink.com/content/100177/</a>	Average USD25.00 per download
Abstract	Braschler, B., Mahood, K., Kruger, N., Chown, S.L., Gaston, K.J. <i>Ant diversity patterns in the Cape Floristic Region.</i> Sept. 2008.	British Ecological Society	<a href="http://www.britishecologicalsociety.org/articles/meetings/current/2008_annualmeeting/session/?session=283">http://www.britishecologicalsociety.org/articles/meetings/current/2008_annualmeeting/session/?session=283</a>	Free

Type	Detail	Publishers	Available from	Cost £
Newspaper article	<i>City scientists lead South Africa study.</i> Yorkshire Post. 16.12.08	Yorkshire Post Newspapers Limited	<a href="http://www.yorkshirepost.co.uk/localnews/City-scientists-lead-South-Africa.4796185.jp">http://www.yorkshirepost.co.uk/localnews/City-scientists-lead-South-Africa.4796185.jp</a>	Free
Journal article	K. Reinhardt (2009). <i>Ento '09 and Entomology at the University of Sheffield. Antenna</i> , <b>33</b> , 55–61 [Mentions limbovane and includes two photographs]	Royal Entomological Society.	See <a href="http://www.royensoc.co.uk/publications.shtml#publication_7">http://www.royensoc.co.uk/publications.shtml#publication_7</a>	Subscription from £35 pa
Website	<i>Sheffield scientists help shape South African curriculum</i>	Defra (Darwin)	<a href="http://darwin.defra.gov.uk/news/2008-12/iimbovane/">http://darwin.defra.gov.uk/news/2008-12/iimbovane/</a>	Free
Website	<i>Sheffield scientists help shape South African curriculum</i>	Insciences Organisation, Switzerland	<a href="http://insciences.org/article.php?article_id=720">http://insciences.org/article.php?article_id=720</a>	Free
Website	<i>Sheffield brings biodiversity to South Africa</i>	Yorkshire Forward	<a href="http://www.yorkshire-forward.com/news-events/local-news/sheffield-brings-biodiversity-to-south-africa">http://www.yorkshire-forward.com/news-events/local-news/sheffield-brings-biodiversity-to-south-africa</a>	Free

## Annex 6 Darwin Contacts

Ref No	14012
Project Title	limbovane Outreach Project: Exploring South African Biodiversity and Change
UK Leader Details	
Name	Professor Kevin J Gaston
Role within Darwin Project	Project leader
Address	University of Sheffield, Department of Animal and Plant Sciences, Alfred Denny Building, Western Bank, Sheffield S10 2TN
Phone	
Fax	
Email	
Partner 1	
Name	Professor S.L. Chown
Organisation	Centre for Invasion Biology, University of Stellenbosch
Role within Darwin Project	Project leader in South Africa
Address	Centre of Excellence for Invasion Biology Faculty of Science Natural Sciences Building Private Bag X1 University of Stellenbosch Matieland 7602
Fax	
Email	
Partner 2	
Name	Mr. Tommy Botha, Senior Curriculum Planner, Life Science and Agriculture
Organisation	Western Cape Education Department
Role within Darwin Project	Representative of government partner organisation
Address	Western Cape Education Department Private Bag X 9114 Cape Town 8006
Fax	-
Email	



## **Annex 7**

**Selection of photos illustrating various aspects of the project.**

Site identification



Theory: (ants, biodiversity, pitfalling & using a key)



Setting & collecting traps



Vegetation surveys



Processing samples



Brainstorming



Ant identification









## Field classes with Grade 10 learners







**IMBOVANE:  
EXPLORING SOUTH AFRICAN  
BIODIVERSITY AND CHANGE**


*Celebrating the Successes  
of Phase I  
and the  
Transition to Phase II*







**imbovane hand-over/celebration event,  
Stellenbosch September 2008**

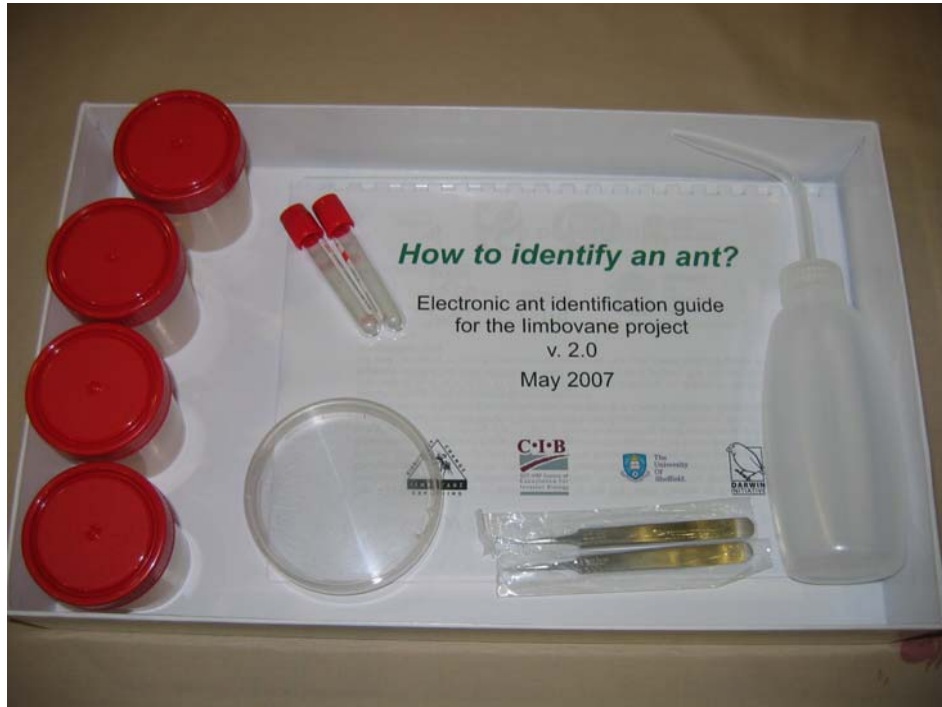



***IMBOVANE OUTREACH***  
***Bringing science & education  
together***

- Curriculum-based project for Grade 10 Life Science
- Develop biodiversity skills in educators
- Teach learners about the importance of biodiversity in their day-to-day lives
- Links into classroom activities on Biodiversity, Continuity & Change
- Use ants as a surrogate to teach and learn about biodiversity

*Imbovane: Exploring South African Biodiversity and Change*

## Sampling kit (as supplied to schools) and part of ant reference collection



# Annex 8 Methodology, results.

## 1. Sampling procedures and identification

Ants were collected at 13 transformed sites associated with schools, 13 natural 'control' sites close to the schools, and in a further eight sites located in habitat types that were otherwise underrepresented. Two grids of 10 pitfall traps (10 m apart) each were set in each site in a way that captured the local habitat diversity. Sampling was carried out bi-annually in spring (October) and autumn (March) when ants are most active in this region. The traps were 7 cm diameter plastic beakers buried so that the rim was flush with the ground. Traps were partly filled with 50% propylene glycol solution and then left open for five days at a time before collection.

Samples were returned to the labs at C••B . Preliminary sorting was done by technicians and project staff, and identification by scientific project staff. Voucher specimens were checked with Dr Hamish Robertson from Iziko Museums (Cape Town). Morphospecies were also compared to an existing reference collection from the northern Cape Floral Region [Coast to Karoo transect]. A reference collection has been completed with details of specimens also entered into a searchable database. This reference collection will be held at the CIB and be matched to that of other projects.

## 2. Equipment and training

Schools were provided with the necessary equipment and teacher-training for their participation in the project. Each school received:

- One high quality stereomicroscope with built-in digital camera. The first 10 schools also received a second microscope.
- Laptop computer
- Lab material (petri dishes, forceps)
- Ant reference collection with example specimens for genera found on school grounds
- Image-based key to subfamilies and genera
- Worksheets, lesson plans, and teaching guides
- Training of participating teaching staff in methodology and theory relevant to the project (e.g., microscopy, biodiversity theory).

All other material needed (including compass, GPS, clinometer, thermocron i-buttons, measuring tapes and poles, clipboards and protocol sheets) was brought to the schools on survey days but remained in the possession of the project and could thus be used for several schools.

Teachers (and curriculum advisers) were trained in methods, procedures and example lessons via a series of workshops. These workshops were adapted in response to specific requests from teachers and always comprised a feedback element during which the way forward could be discussed. For example on one occasion, teachers requested further training on curating a reference collection, including the mounting of ants.

In addition to supervising the field sampling at schools, limbovane staff gave lessons in each school on biodiversity, ant biology, the scientific method, and data analysis and presentation of results. Learners were also taught to calculate simple biodiversity indices like species richness and Simpson's diversity and compare results between sites using graphs.

## 3. Results

In the first two full calendar years of the project, over 87,750 individuals belonging to 159 morpho-species in 32 genera were collected across all 33 sites of the project. Of these 70 species were found in the 13 transformed school sites combined and 149 species were found in the other 20 sites. For sites in the Cape Floristic Region, species richness was much lower in transformed sites than in natural sites, but species density was similar.

Large ant species were absent or rare in many transformed sites, while some small and subterranean species occurred in large numbers in these areas. The invasive alien Argentine ant (*Linepithema humile*) was abundant in most transformed sites and was often the most abundant species found in the school sites. In contrast this species was only found in one nature reserve, where it occurred in very low abundance. However, the most common ant in transformed sites was the indigenous seed disperser *Tetramorium quadrispinosum*. This indicates that transformed sites retained some functionality.

In addition to providing new knowledge on ant diversity and distributions across the Western Cape, and mechanistic underpinnings, new knowledge about the ranges of some South African species has been added. For example numerous *Diplomorium* workers were found in two sites in the Western Cape representing a Renosterveld site and an ecotonal site between Succulent Karoo and Fynbos. *Diplomorium* was previously only reported from the Eastern Cape Province at the eastern end of the Cape Floristic Region.

The ant diversity of the CFR and Succulent Karoo is relatively high but not higher than could be expected based on energy availability (temperature, productive energy (NDVI)). In contrast to plants, ant diversity is thus not exceptionally rich in the region. Comparisons with shrublands in other regions similarly show that the CFR and SK are not atypical in this regard.

#### FULL LIST OF SPECIES (as at September 08)

Species/morphospecies	Total number of individuals collected	Number of sites where species was found
<i>Acropyga arnoldi</i>	1	1
<i>Aenictus rotundatus</i>	4	2
<i>Anochetus levaillanti</i>	10	7
<i>Anoplolepis custodiens</i>	20491	7
<i>Anoplolepis steingroeveri</i>	2103	11
<i>Brachymyrmex sp. 1</i>	6	3
<i>Camponotus angusticeps</i>	6	2
<i>Camponotus baynei</i>	24	3
<i>Camponotus cintellus</i>	3	1
<i>Camponotus cunaeiscapus</i>	19	6
<i>Camponotus fulvopilosus</i>	210	12
<i>Camponotus irridux</i>	20	5
<i>Camponotus maculatus group</i>	30	9
<i>Camponotus mystaceus</i>	13	1
<i>Camponotus niveosetosus</i>	48	14
<i>Camponotus sp. 13</i>	5	2
<i>Camponotus sp. 13B</i>	1	1
<i>Camponotus sp. 13C</i>	4	2
<i>Camponotus sp. 14</i>	5	1
<i>Camponotus sp. 16</i>	10	3
<i>Camponotus sp. 17</i>	14	5
<i>Camponotus sp. 18</i>	14	2
<i>Camponotus sp. 2</i>	4	1
<i>Camponotus sp. 25</i>	10	1
<i>Camponotus sp. 26</i>	10	1
<i>Camponotus sp. 28</i>	3	2
<i>Camponotus sp. 3</i>	39	3
<i>Camponotus sp. 31</i>	4	1
<i>Camponotus sp. 6</i>	9	5
<i>Camponotus sp. 7</i>	3	1
<i>Camponotus sp. 8</i>	19	1
<i>Camponotus sp. maculatus group</i>	144	16
<i>Camponotus vestitus</i>	132	8
<i>Cardiocondyla shuckardi</i>	294	11
<i>Cerapachys sp. 4</i>	4	1
<i>Cerapachys sp. 5</i>	1	1
<i>Crematogaster cf peringueyi</i>	749	11
<i>Crematogaster melanogaster</i>	2359	4
<i>Crematogaster peringueyi</i>	351	10
<i>Crematogaster sp. 1</i>	251	2
<i>Crematogaster sp. 12</i>	68	1
<i>Crematogaster sp. 13</i>	4	1
<i>Crematogaster sp. 3</i>	98	2



<b>Species/morphospecies</b>	<b>Total number of individuals collected</b>	<b>Number of sites where species was found</b>
<i>Crematogaster</i> sp. 6	1	1
<i>Diplomorium</i> sp. 1	336	2
<i>Dorylus helvolus</i>	188	15
<i>Hypoponera</i> sp. 1	27	3
<i>Lepisiota</i> sp. 1	1809	22
<i>Lepisiota</i> sp. 2	240	7
<i>Lepisiota</i> sp. 3	21	3
<i>Leptogenys attenuata</i>	2	1
<i>Leptogenys castanea</i>	11	3
<i>Leptogenys peringueyi</i>	2	1
<i>Leptothorax</i> sp. 1	8	3
<i>Leptothorax</i> sp. 10	55	2
<i>Leptothorax</i> sp. 11	16	2
<i>Leptothorax</i> sp. 12	3	2
<i>Leptothorax</i> sp. 13	3	1
<i>Leptothorax</i> sp. 17	1	1
<i>Leptothorax</i> sp. 18	6	3
<i>Leptothorax</i> sp. 19	1	1
<i>Leptothorax</i> sp. 9	33	1
<i>Linepithema humile</i>	6436	11
<i>Meranoplus peringueyi</i>	2281	13
<i>Messor capensis</i>	1504	14
<i>Messor</i> sp. 3	3	1
<i>Monomorium fridae</i>	1847	3
<i>Monomorium havilandi</i>	949	12
<i>Monomorium macrops</i>	1022	10
<i>Monomorium</i> sp. 11	508	5
<i>Monomorium</i> sp. 12	109	1
<i>Monomorium</i> sp. 15	1293	9
<i>Monomorium</i> sp. 18	22	4
<i>Monomorium</i> sp. 19	3	2
<i>Monomorium</i> sp. 2	1908	12
<i>Monomorium</i> sp. 31	4	2
<i>Monomorium</i> sp. 34	4	1
<i>Monomorium</i> sp. 35	14	1
<i>Monomorium</i> sp. 36	1889	6
<i>Monomorium</i> sp. 36B	395	3
<i>Monomorium</i> sp. 37	162	2
<i>Monomorium</i> sp. 38	340	5
<i>Monomorium</i> sp. 39	187	2
<i>Monomorium</i> sp. 39B	26	1
<i>Monomorium</i> sp. 40	38	1
<i>Monomorium</i> sp. 41	1640	4
<i>Monomorium</i> sp. 45	12	1
<i>Monomorium</i> sp. 46	1	1
<i>Monomorium</i> sp. 47	3	2
<i>Monomorium</i> sp. 5	12	3
<i>Monomorium</i> sp. 7B	313	10
<i>Monomorium</i> sp. 8	564	22
<i>Monomorium</i> sp. 8B	17	3
<i>Monomorium</i> sp. 9	115	5
<i>Monomorium xanthognathum</i>	225	7
<i>Ocymyrmex barbiger</i>	3515	25
<i>Oligomyrmex</i> sp. 1	43	2
<i>Oligomyrmex</i> sp. 2	16	3
<i>Oligomyrmex</i> sp. 3	4	3
<i>Pachycondyla caffraria</i>	76	2

<b>Species/morphospecies</b>	<b>Total number of individuals collected</b>	<b>Number of sites where species was found</b>
<i>Pachycondyla cavernosa</i>	55	2
<i>Pachycondyla granosa</i>	6	1
<i>Pachycondyla hottentota</i>	671	5
<i>Pachycondyla peringueyi</i>	55	2
<i>Pachycondyla pumicosa</i>	12	3
<i>Pachycondyla</i> sp. 1	1	1
<i>Pachycondyla</i> sp. 11	7	1
<i>Pheidole</i> sp. 1	1403	6
<i>Pheidole</i> sp. 10	94	4
<i>Pheidole</i> sp. 12	2280	7
<i>Pheidole</i> sp. 15	333	5
<i>Pheidole</i> sp. 16	3	1
<i>Pheidole</i> sp. 20	513	1
<i>Pheidole</i> sp. 20B	59	1
<i>Pheidole</i> sp. 21	4665	7
<i>Pheidole</i> sp. 4B	216	1
<i>Pheidole</i> sp. 5	730	1
<i>Pheidole</i> sp. 7	329	2
<i>Plagiolepis deweti</i>	1	1
<i>Plagiolepis</i> sp. 1	67	10
<i>Plagiolepis</i> sp. 1B	220	7
<i>Plagiolepis</i> sp. 2	257	9
<i>Plagiolepis</i> sp. 3	11	2
<i>Plagiolepis</i> sp. 4	2	1
<i>Polyrachis spinicola</i>	1	1
<i>Pyramica</i> sp. 1	3	2
<i>Solenopsis punctaticeps</i>	1323	19
<i>Tapinolepis</i> sp. 1	1682	9
<i>Tapinoma</i> sp. 1	18	2
<i>Technomyrmex pallipes</i>	602	19
<i>Tetramorium dichroum</i>	166	7
<i>Tetramorium erectum</i>	81	12
<i>Tetramorium frigidum</i>	272	21
<i>Tetramorium grandinode</i>	169	2
<i>Tetramorium grassii</i>	12	2
<i>Tetramorium quadrispinosum</i>	8332	26
<i>Tetramorium solidum</i>	1190	8
<i>Tetramorium</i> sp. 1	705	22
<i>Tetramorium</i> sp. 1B	176	16
<i>Tetramorium</i> sp. 1C	66	2
<i>Tetramorium</i> sp. 2	1	1
<i>Tetramorium</i> sp. 20	265	3
<i>Tetramorium</i> sp. 20B	911	4
<i>Tetramorium</i> sp. 27	39	4
<i>Tetramorium</i> sp. 29	1	1
<i>Tetramorium</i> sp. 2B	5	1
<i>Tetramorium</i> sp. 2C	118	1
<i>Tetramorium</i> sp. 3	604	27
<i>Tetramorium</i> sp. 31	60	9
<i>Tetramorium</i> sp. 32	2	1
<i>Tetramorium</i> sp. 35	6	1
<i>Tetramorium</i> sp. 46	1	1
<i>Tetramorium</i> sp. 48	1	1
<i>Tetramorium</i> sp. 5	284	12
<i>Tetramorium</i> sp. 51	4	1
<i>Tetramorium</i> sp. 5C	1	1
<i>Tetramorium</i> sp. 5D	5	3

<b>Species/morphospecies</b>	<b>Total number of individuals collected</b>	<b>Number of sites where species was found</b>
<i>Tetramorium sp. 6</i>	8	2
<i>Tetraponera clypeata</i>	1	1

Note that some ants are, at present, only identified as morphospecies

# Annex 9 Publicity

## Year 1: 2005–6

### Press releases

University of Sheffield press release: "Monitoring ants leads to big changes for South African students"  
13 December 2005  
<http://www.shef.ac.uk/mediacentre/2005/510.html>

### Radio and Television

Mahood, K. 2006. Interview on Radio Sonder Grense concerning the limbovane project. March 2006  
Mahood, K. 2006. Interview on SAfm concerning the limbovane: Exploring South African Biodiversity and Change Outreach Project. January 2006

### Posters

Mahood, K., Chown, S.L., Davies, S.J., Kruger, N. and Gaston, K.J. limbovane: Exploring Biodiversity and Change. *Arid Zone Ecology Forum, Barrydale, Western Cape Province, 2005.*

## Year 2: 2006–7

### Popular articles and talks

Mahood, K. limbovane: Exploring South African Biodiversity & Change. *Invited talk to the Rotary Club of Somerset West. July 2006.*

### Radio and Television

Kruger, N. 2006. Interview by Groen "Bewonder en Bewaar" Kyk-Net television, for a 10 minute insert about the limbovane project. Aired May 2006.  
Mahood, K. Interview by Groen "Bewonder en Bewaar" Kyk-Net television, for a 10 minute insert about the limbovane project. Aired May 2006.

### Posters

Botes, A., McGeoch, M.A., Robertson, H.G., Van Niekerk, A., Davids, H.P., Mahood, K. and Chown, S.L. Ants, Altitude and Change in the Northern Cape Floristic Region. *South African Environmental Observation Network Summit, Pretoria, Gauteng, 2006.*  
Braschler, B. Mahood, K., Chown, S. L., Kruger, N. and Gaston, K. J. limbovane: Exploring South African Biodiversity and Change. *South African Environmental Observation Network Summit, Pretoria, Gauteng, 2006.*  
Damonse, B.A., Mahood, K. and Mokoena, S. Extra-curricular high school science education programmes and monitoring: Using research for delivery. *Plenary lecture, South African Environmental Observation Network Summit, Pretoria, Gauteng, 2006.*

## Year 3: 2007–8

### Popular articles and talks

Kruger, N. and Mahood, K. limbovane: Exploring South African Biodiversity and Change outreach project: Benefiting all involved. *Ward Council meeting for Kraaifontein Municipality, September 2007.*

### Radio and Television

Mahood, K. Interviews for Beyond the Classroom, SABC 2. Aired 2 December 2007 and repeated on 3 December 2007.

### Conference presentations

Braschler, B., Kruger, N., Mahood, K., Gaston, K.J. and Chown, S.L. Ant diversity patterns in the Cape Floristic Region. *21st Annual Meeting of the Society for Conservation Biology, Port Elizabeth, South Africa, July 2007.*  
Mahood, K., Braschler, B., Kruger, N., Gaston, K.J. and Chown, S.L. limbovane: Exploring South African Biodiversity and Change outreach project. *IV World Environmental Education Congress, Durban, South Africa, July 2007.*  
Mahood, K., Kruger, N., Braschler, B.M., Gaston, K.J. and Chown, S.L. limbovane: It's about the learners. *Fynbos Forum Meeting, Langebaan, August 2007.*  
Mahood, K. and Kruger, N. Biodiversity in Action. *South African Association of Science and Technology Educators Mini-Conference, Tokai, September 2007.*  
Van Zyl, E. Die limbovane Uitreik Projek. *South African Association of Science and Technology Educators Mini-Conference, George, January 2008*

## Posters

Mahood, K., Kruger, N., Braschler, B.M., Gaston, K.J. and Chown, S.L. *limbovane: It's about the learners*. Fynbos Forum Meeting, Langebaan, August 2007.

Braschler, B., Kruger, N., Mahood, K., Gaston, K.J. and Chown, S.L. Ant diversity patterns in the Cape Floristic Region. 21st Annual Meeting of the Society for Conservation Biology, Port Elizabeth, July 2007.

Mahood, K., Braschler, B.M., Kruger, N., Gaston, K.J. and Chown, S.L. *limbovane: Exploring South African Biodiversity and Change Outreach Project*. IV World Environmental Education Congress, Durban, July 2007.

## Youth symposia and expos

South African Women in Science and Engineering day to raise awareness among schoolgirls about careers in Science, Engineering & Technology (9 August 2007).

Eskom Expo for Young Scientists (Cape Town regional finals).

Youth Environmental Schools Symposium.

## Year 4: 2008–9

### Radio and Television

Mahood, K. 2008. Discussion of the limbovane project and the upcoming function on the 11th of September with Jacqui January on the programme *EkoForum*, Radio Sonder Grense (RSG). Aired on 31 August 2008.

Mahood, K. Khoza, T. and learners from Cape Academy for Maths, Science and Technology. 2008. Interviewed by Michelle Garforth for *Bush Radar*. To be aired on SABC 2 (upcoming).

### Press releases:

UK:

Press release, 15th Dec. 08. "Sheffield scientists help shape South African curriculum"  
<http://www.shefac.uk/mediacentre/2008/1138.html>

Yorkshire Forward, 15 Dec 2008. (Online) "Sheffield brings biodiversity to South Africa"  
<http://www.yorkshire-forward.com/news-events/local-news/sheffield-brings-biodiversity-to-south-africa>

Yorkshire Post, 16 Dec 2008. (Online and printed). "City scientists lead South Africa study"  
<http://www.yorkshirepost.co.uk/localnews/City-scientists-lead-South-Africa.4796185.jp>

Insciences Organisation, Switzerland – Featured the University news release on their website on 15/12/08. 'Sheffield scientists help shape South African curriculum'.  
[http://insciences.org/article.php?article\\_id=720](http://insciences.org/article.php?article_id=720)

Darwin Initiative website: "Sheffield scientists help shape South African curriculum"  
<http://darwin.defra.gov.uk/news/2008-12/iimbovane/>

Biodiversity & Macroecology Group (University of Sheffield) website has been updated:  
[http://www.biome.group.shef.ac.uk/BD\\_dist\\_and\\_monitoring.htm](http://www.biome.group.shef.ac.uk/BD_dist_and_monitoring.htm)

South Africa:

Stellenbosch University website: "limbovane ant education project geared for next phase"  
[http://www.sun.ac.za/News/NewsItem\\_Eng.asp?Lang=2&ItemID=14712](http://www.sun.ac.za/News/NewsItem_Eng.asp?Lang=2&ItemID=14712)

Article in e-Standard (Gazette). "School: sizing up ants"  
<http://www.breedde.com/article.asp?newsID=8497>

### Conference posters and presentations

Kruger, N., Mahood, K., Braschler, B., Chown, S. L., & Gaston, K.J. *limbovane: Engaging Society*. Poster presentation at a community interaction symposium held on the 3rd April 2008 at Stellenbosch University. [This poster won 3rd prize of R1000].

Mahood, K., Kruger, N., Braschler, B. M., Gaston, K. J. & Chown, S. L. *Projects Linking Science Research and the Community – Examples and Ideas*. The 93rd Ecological Society of America Annual Meeting held in Milwaukee, Wisconsin on 3rd - 8th August 2008.

*limbovane: Exploring South African Biodiversity and Change outreach project*. The Darwin Initiative handover function held at STIAS Wallenberg Centre, Stellenbosch on 11th September 2008.

- Braschler B, Gaston KJ, Chown SL. Invasion biology, biodiversity monitoring and public awareness: Realizing a synergy for resource poor countries. Poster presentation at *Fifty years of invasion ecology: the legacy of Charles Elton*. C•I•B Annual Research Meeting, Stellenbosch, 12-14 November 2008.
- Braschler B, Mahood K, Kruger N, Chown SL, Gaston KJ. Ant diversity patterns in the Cape Floristic Region. *British Ecological Society Annual Meeting*, Imperial College London, 3-5 September 2008.
- Braschler, B., Mahood, K., Chown, S. L., Kruger, N., Shaw, S.C. & Gaston, K.J. *limbovane: Exploring South African Biodiversity and Change*. Poster presentation at University of Sheffield Environment Division symposium: Society, Science & Technology - 17th November 2008.
- Kruger, N., Mahood, K., Braschler, B., Chown, S. L., & Gaston, K.J. *limbovane: Engaging Society*. Poster presentation at University of Sheffield Environment Division symposium: Society, Science & Technology - 17th November 2008.
- Braschler B, Mahood K, Karenyi N, Gaston KJ, Chown SL. *Ant diversity patterns in the Cape Floristic Region*. Invited talk at the Annual General Meeting of the Department of Botany and Zoology, Stellenbosch University, 27-28 November 2008.

### **Posters**

- Mahood, K., Kruger, N., Braschler, B.M., Gaston, K.J. and Chown, S.L. limbovane – Its not just ants. *Ecological Society of America, August 2008*.
- Kruger, N., Mahood, K., Braschler, B.M., Chown, S.L. and Gaston, K.J. limbovane: Engaging Society. *Stellenbosch University in house Community Interaction Symposium, April 2008*.

### **Youth symposia and expos**

- Kirstenbosch Biodiversity Expo, 22 May 2008, Kirstenbosch National Botanical Garden.
- Eskom Expo for Young Scientists, August 2008. Learners from a local high school submitted four projects relating to limbovane. These projects were awarded various medals, including one bronze, one silver and two gold medals. The gold medal winners will have an opportunity to improve their work before going to National finals later in the year.

# Annex 10 Quotes and Anecdotes

## Examples of comments and questions by scholars

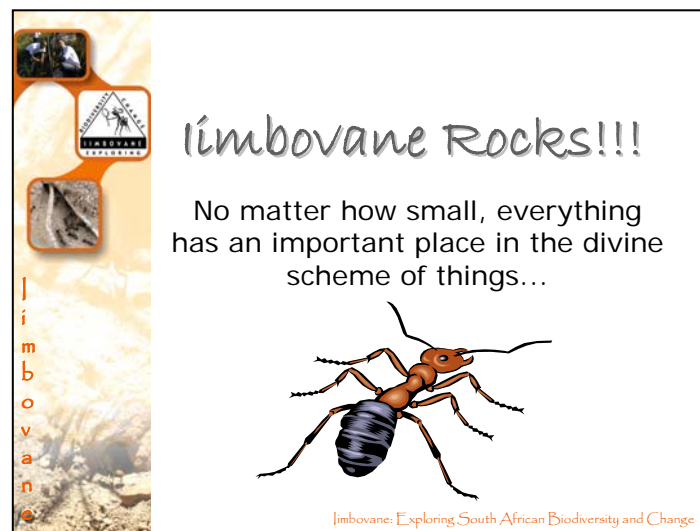
*"I have fallen in love with the wonders of science"* Scholar declaring her intention to study science

*"Is it true that one needs to study for 30 years to become a scientist?"* Question posed by various scholars

*"Does one need to be good at maths to become a biologist?"* Another frequent question

*"At first I thought limbovane would be an uninteresting term that all Life Science students would learn about, but yet again I was wrong!!! From the start I loved limbovane because we learned many important facts about a form of life which we destroy and trample without a second thought. .... limbovane opened my eyes and jolted my interest in science as a profession such as Zoology, Microbiology and other BSc degree professions. After the week I spent at the workshop – I believe that science is the "coolest" and best profession for anyone who loves science."* From a piece written by a scholar for the project celebration hand-over event (Sept. 08).

At the project celebration/hand-over event (Sept 2008; see Annex 7), three learners were overheard discussing the limbovane project and their participation in it during 2007. They concluded that it would be best if limbovane was converted from a Grade 10 project to a Grade 12 project, so that they would have the opportunity to take part in it again. The final slide of the presentation about limbovane given by a learner at this event aptly summarised her feelings about the project:



### Comments by teachers

*"This project changed the abstract theory into a well understood reality for our learners."*

*"You [the limbovane team] are role models, living proof of what can be accomplished. Many learners were inspired to further their studies."*

### Comments by WCED

In a letter of thanks received by the limbovane team at the end of 2007, the WCED stated that *"Your energy, enthusiasm and knowledge of your subject are invaluable to our teachers and learners."*

### Quote from ECTF review of 3<sup>rd</sup> annual project report to Darwin (June 2008)

*"This is an amazing project linking teachers and learners with scientists so that the work that pupils do is real science and not just a learning exercise. It allows pupils to be scientists generating valuable data. It puts biodiversity into real life and teaches appreciation of real local environmental issues the monitoring of which schools can take real responsibility for supported by the project. The whole concept of this project should be considered very good practice."*