Darwin Initiative – Final Report

*(To be completed with reference to the Reporting Guidance Notes for Project Leaders (http://darwin.defra.gov.uk/resources/reporting/) - it is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)*

Darwin project information

Project Reference	14-059
Project Title	Certification to support conservation of endangered Mexican desert cacti
Host country(ies)	UK
UK Contract Holder Institution	The University of Reading (UoR)
UK Partner Institution(s)	
Host Country Partner Institution(s)	Universidad Autónoma de Querétaro (UAQ), Mexico
Darwin Grant Value	£240 106
Start/End dates of Project	September 2005 –August 2008
Project Leader Name	Julie A. Hawkins
Project Website	www.uaq.mx/ccma
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1 Project Background

The project addresses the need to regulate trade in wild cacti. Mexico is a country with remarkable cactus biodiversity and potential to supply the international and national market for cacti. The project has developed DNA fingerprinting and DNA bar-coding for forensic and certification purposes, so that the identification, tracking and sharing of information on traded plants is now possible. The project has developed a stakeholder-negotiated framework, which when implemented will facilitate a fairer sharing of benefits arising from horticultural trade. Mexican biologists have been trained, and a laboratory where the techniques are used has been established.

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

The illegal cactus trade presents a significant challenge to Mexico in terms of meeting obligations as a signatory of the CBD. Mexican legislation prohibits the trade of wild-collected cacti. Nursery growers, however, may collect wild plants under permit to serve as mother plants for propagation. The absence of a scheme certifying plants as nursery progeny of legally collected plants and widespread illegal trafficking serve to undermine growers' legitimate trade. Additionally, enforcement can be limited by difficulties in species identification. In order to implement the CBD in Mexico, new tools were needed which could track the chain of production of plants, from legally collected mother plant to consumer (certification) and identify illegally traded plants (forensics). We have transferred DNA tools to Mexico which can meet these needs. Their informed application could limit illegal trade, supporting the conservation, sustainable harvest and use of Mexican desert cacti, whilst ensuring that the various stakeholders get a fair and equitable share of the benefits arising out of their exploitation by the horticultural trade. We have delivered a stakeholder dialogue as the first step towards their application to these ends.

The transfer to Mexico of these DNA tools, alongside stakeholder dialogue, has significantly enhanced Mexico's ability to meet obligations as a signatory of the CBD. By providing a DNA-

based identification tool and a stakeholder-negotiated certification scheme for nursery-propagated, traded cacti, the project has

- proposed a mechanism of regulation for management of activities
- facilitated cooperation between governmental authorities and the private sector
- encouraged the use of biological resources in a way that minimises adverse impacts on biological diversity
- provided a framework whereby sharing of the benefits arising from the commercial utilisation of genetic resources can be fair and equitable
- built capacity in biotechnology

We meet the UK's obligations by providing education and training in biotechnology and technology transfer relating to use of genetic resources, through exchange of information and specialised knowledge and expertise.

The likelihood of future enhanced implementation of the CBD in Mexico depends on a number of factors. These include

- marketing of the genetically certified plants to secure a volume of trade in certified plants which is enough to impact on the livelihoods of the communities
- the ongoing support of the Mexican authorities, including finalisation of Prior Informed Consent (PIC)
- long-term funding for a centre for the propagation and curation of certified plants, and the application of the molecular tools
- further development of the DNA tools, to extend them to more species than the two species trialled in this project

Since the project was initiated, Dr Barcenas Luna has been promoted to curate the UAQ Botanic Garden. This has ensured a centre where plants can be propagated and maintained that is associated with the newly established Darwin Laboratory for plant certification. This is very good news for the future implementation of the scheme. Resources to further develop the marketing and trade of the certified plants are being sought, but the enthusiasm of the Mexican authorities for the project, and the media interest that the project has developed may help to secure a market and significant and sustainable legal trade.

One other prerequisite for the implementation of certification to meet CBD objectives is the availability of trained staff to work in the Darwin Laboratory for plant certification. The partnership between the UoR and UAQ through the Darwin Initiative funded project allowed the establishment a basic but fully functional molecular laboratory at UAQ. The Darwin Laboratory of Molecular Systematics and Evolution can identify species through barcodes and will be capable of identifying individuals and populations through fingerprints for certification and for forensic and law enforcement activities. Staffing the laboratory depends on continuity of employment of trainees. Three host country students visited the molecular laboratories at UoR to be trained in molecular techniques increasing the human resources capabilities in Mexico. One of the students was able to successfully obtain a graduate scholarship from the Mexican government to continue the genetic analysis of several Mexican endemic species of cacti at the UoR. The student will return to Mexico to develop scientific projects and train other national students applying the new techniques learned during the development of his studies. However, the availability of the trainees to work in the laboratory is not assured. We are presently seeking routes by which a permanent technician post can be established.

To meet the 2010 objective for cacti depends on the participation of local communities in the protection of populations of rare species which are currently decimated by illegal collection. Our project is the first step towards providing a sustainable way of engaging local communities in the preservation of species by engaging them in the sustainable use of those resources. Presently local people only get financial benefit from illegal activities, not necessarily through directly illegally collecting the plants, but perhaps through association with "professional" illegal collectors. When our stakeholder-negotiated framework is implemented and fair and equitable

sharing of the profits arising from legal trade is in place, the protection of the resources is secured as well as providing income for the communities.

The project developed a certification scheme for trading legally propagated cacti in accordance to national and international laws. Particularly, the project always kept in mind the creation of a fully CITES compliance scheme to be able to export plants for the international market as stated on the initial application grant. A Mexican CBD authority representative and representative of the CITES authority was invited to participate in the stakeholder dialogue.

3 Project Partnerships

The Mexican and UK PIs worked together closely to prepare the Darwin application, drawing on their complementary expertise to put together a project which both found very exciting. The Mexican PI drew the UK PI's attention to the need in Mexico, and the two partners together developed the idea of DNA certification. The partnership for this project was based on a specific need in Mexico for a precise scientific tool to detect fraudulent trade in desert cacti and to ensure a fair and equitable share for rural communities and to the country in general. Illegal trade on endemic Mexican species does not provide fair shares to the people but certainly endangers natural populations increasing present and future poverty for the communities. The ongoing development of the project always involved the collaboration and interchange of ideas and results between the two PI's, the technicians and students. The management of the project was made more challenging by the lack of continuity in the post of UoR post-doc, and by the pregnancy of the UK PI. We were lucky to turn the staffing changes to our advantage by employing post-docs with complementary skills, but it was more difficult to fully engage the post-docs joining the project late with the ethos of the project. The UK PIs pregnancy and the arrival of her baby three months before the end of the project made it challenging to deliver a second stakeholder meeting.

The UK PI travelled twice to Mexico in order to discuss strategies, to assess progress, and to participate on the first stakeholders' meeting in the host country. The UK PI also took an active role in developing fieldwork in various desert regions in Mexico while discussing strategies to speed up the collection of plant materials. The Mexican PI visited the UK twice in order to interchange information on progress, for team-building, to discuss preliminary results and to get training in some technical aspects of the molecular aspect of the project. The application, half year and annual reports and this final report were written in close cooperation among the two PI's. Communication via email and specially VoIP technology (Skype) allowed discussion and problem solving.

An MoU was agreed at the beginning of the project to be able to clarify mutual responsibilities and to ensure that the benefits of the project were shared in an equitable manner. Nevertheless there were some issues that were problematic, for example the availability of the Mexican PI to develop fieldwork in Mexico was limited by his teaching and administrative responsibilities at UAQ. We also learned that it was necessary to hire a major and a minor technician for the project instead of only one technician, in particular to increase the rate of production of field specimens and herbarium specimens and for safety in the field. In this way, the collection of fresh living samples could have followed the specified plan. Also, UoQ does not have a system for providing PI's minor amounts of petty cash for urgent or minor expenses, thus increasing the time for the acquisition of important supplements such as payments for delivery services. These minor expenses have been met as far as possible by the Mexican PI's personal funds, but there have been delays in payments to providers in the release of parcels. The financial issues proved a impediment to the delivery of fieldwork.

In the UK, discussions were held with staff from institutions that are not project partners. These include discussions with staff at the Royal Botanic Garden Kew and the Eden Project. The former provided important insights into the geographic distribution of target species and suggested ways of accessing seized plants for testing. The latter discussed marketing strategies for horticultural trade. Members of the British Cactus and Succulent Society approached us to share their views. In Mexico, a number of institutions were involved in the stakeholder dialogue, and throughout the project new individuals and institutions came on board to contribute to the development of the scheme.

4 Project Achievements

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

Our stated goals were not to establish certified plants in trade, but to lay the foundations for legal trade which would support conservation and ensure a fair share of benefits to stakeholders. To prepare the way for such trade we developed a framework in which trade could operate and provisioned the scientific tools to deliver this trade. Thus, the project's impact is not in terms of species conserved or increased sustainable use. What we have achieved is a wide-reaching and lively debate about how the future trade in Mexican desert cacti might develop in accordance with the objectives of the CBD. Also, the confidence and knowledge in Mexico, in terms of competence with molecular markers and institutional capacity is considered a positive impact. These factors are predicted to have a positive and long-lasting impact on biodiversity, sustainable use and equitable sharing once the trade in certified plants is established.

Future impacts on specific elements of biodiversity will be driven by future trade in the two plants genotyped for certification. Income generated from the sale of certified plants will be directed towards engaging local communities in conservation. If sales generate sufficient funds to benefit local communities and engage them in conservation activities then the two certified species will be secured in the wild. Trade will begin once the plants of certified genotypes which we are growing for the trade launch are large enough.

In the future, the microsatellite database could be used to determine the provenance of plants already in trade. The re-introduction of plants for genetic enhancement of genetically eroded populations could be guided by microsatellite data collected in this project for certification purposes. This is the topic of the Mexican PhD student currently at the University of Reading, co-supervised by the Mexican and UK PIs.

The barcoding data and the collection data associated with it will be freely available in international sequence databases. Whilst the database has not resulted in a positive impact on biodiversity, sustainable use or equitable sharing in the lifetime of the project, it might be expected to have future impact. It forms part of a permanent record of the genetic and biogeographical diversity in Mexican desert cacti that can be used in baseline recording of temporal change in biodiversity and in conservation planning. The UK and Mexican PIs are planning to collaborate on a research question about the distribution of biodiversity in Mexico using the barcoding and associated data which will be over-and-above the current project's goals, and which may impact on conservation decisions.

4.2 Outcomes: achievement of the project purpose and outcomes

The project achieved its purpose by developing microsatellites and genetic barcodes for the Mexican species of cacti, training Mexicans to use genetic technologies to test the provenance and identity of plants and initiating stakeholders' dialogue. These are the necessary precursors to support conservation, sustainable harvest and use of Mexican desert cacti, and to ensure a fair distribution of benefits through certification.

At the time the project proposal was submitted, Mexican authorities sought to control trade through unenforceable strategies which depended severely limiting or banning trade altogether, strategies which meant that most international trade was illegal, and only illegal traders benefited. There is a low rate of successful prosecutions of an illegal trader, although the national strategy was one deterrent, because legal provenance was hard or impossible to demonstrate. In this legislative environment a lot of bureaucracy discouraged legal traders from exporting and new nurseries had problems gaining permission to open. Our project has brought a fresh and innovative approach to break this deadlock. Our experience with stakeholders including national authorities has shown that certification is now seen as a new way of operating, one which may open up trade to benefit all.

4.3 Outputs (and activities)

The project achieved its outputs as laid out in the logical framework, except that the full fieldwork schedule could not be carried out, the timing of the second stakeholders' meeting and training course was delayed. The second stakeholders' meeting was shorter than originally planned, and the main training course was relocated to the UK.

As discussed in previous reports, fieldwork was limited by the workload of the Mexican PI, the availability of field assistants and the climate. In order to ensure an adequate sample of species included in our study, we made use of living collections and existing herbarium vouchers from Mexican herbaria. We sought permission to hold the final training session in the UK rather than Mexico. This was for a number of reasons. 1. The Mexican PI requested the change in venue, because it is difficult for him to concentrate on training and to create focused free time because of his numerous responsibilities to his employers, UAQ. 2. The Mexican PI noted that the three students most likely to be involved in the delivery of the technical aspects of the project have already been trained in Reading, so there isn't a cohort of Mexicans to be trained - he considered himself to be the only untrained potential participant. 3. We can teach a range of software here in Reading which will inform the Co-PIs decision-making on which software he prefers to run for fragment analysis in Mexico. 4. One additional output of the training in Mexico was to ensure the smooth-running of the Mexican lab. However, the UK-PI made an unscheduled trip to Mexico in July (following the recommendation of our external reviewer), and in addition to joining the Mexican PI in the field the UK-PI reviewed practices in the Mexican lab, so this aspect of the training has already been delivered. Delays to the training had a knock-on effect on the timing of the second stakeholder meeting. Because the UK PI wanted to input into the stakeholder meeting and couldn't travel because of a pregnancy, the second stakeholders' meeting was rescheduled to take place after this training course, which afforded the Mexican and UK PIs to have full and detailed discussions about the structuring of the meeting. Although the main training was held in Reading, the first Mexican exchange student, now a PhD student registered in Reading and co-supervised by the Mexican PI, was able to deliver training in UAQ when he returned to Mexico for fieldwork.

- Negotiated stakeholders' strategy

Two stakeholders' meetings were held, both in Mexico City). The first stakeholders' report was distributed to the participants and is available in pdf form on the website. The agenda for the second stakeholders' meeting is also available in pdf form on the website. The second stakeholders' meeting was shorter, with fewer participants than originally intended. The Mexican PI found it more effective to meet on a one-to-one basis with stakeholders with very different relationships with the project, so dialogue was also progressed in this way. Although the stakeholder dialogue did not progress as originally envisaged, we are confident that we have delivered documents which fairly represent the views of our major stakeholders and which will guide the establishment of DNA certified fair trade in Mexican desert cacti.

- Fieldwork and collections

Approximately 180 person-days of intensive fieldwork were devoted to collection of the materials for DNA extraction, the associated herbarium vouchers and geographic distribution data. A database of the distribution data has been compiled by the Mexican PI. 750 new herbarium vouchers were deposited in the UAQ herbarium, including associated information, and 735 samples of tissues dried in silica gel are banked at UAQ. 150 living plants were collected and are now included in the UAQ botanic garden collection. More than 1500 photographs of the specimens and their natural environments are associated with the scientific collection. The DNA bank at the Darwin Laboratorium of Molecular Systematics and Evolution includes 129 samples of *Ariocarpus bravoanus* DNA, 177 samples of *Echinocactus grusonii* DNA and 735 other samples of DNA of other species. Maps of the populations of *Echinocactus* (three populations) and *Ariocarpus* populations (three populations) have been made. 120 plants have been propagated by tissue culture; 60 of these plants are in permanent culture, this means, mother plants producing new ramets; 54 are growing in soil and the complete collection is in cultivation at UAQ – these are the genotyped plants which will eventually be traded.

- Genetic markers

We set out to collect genetic data for 640 species and 800 individuals. Our final, checked DNA sequence database comprises sequences for 689 species in total including 689 sequences for the *matK* region, 89 for the *ITS* region and 129 for the *rcpo1*. We fingerprinted 134 individuals of *Ariocarpus bravoanus* and 267 of *Echinocactus grusonii*. The microsatellite and sequence data is held on data bases duplicated in UoR and UAQ. The microsatellite primers and sequences described in the publications are available on a public database. We plan to submit the sequences to a public database when we submit the scientific paper describing their use as barcodes.

- Training

Three Mexican students were trained in molecular techniques, spending a total of 52 weeks in UoR and attending the molecular systematics short course delivered by that institution. The Mexican PI visited Reading for further training (see above). Two students are currently developing their theses under the supervision of the Mexican PI using the facilities established through the Darwin funding at UAQ. Victor Manuel Rodríguez, the first Technician at the UAQ and currently developing his postgraduate studies at UoR and the Mexican PI, organised a short intensive course about the application and production of microsatellites at the UAQ. This course was attended by six students directly involved with the study and conservation of genetic variability in Mexico, from Century Plants (*Agave* spp.), through Cacti to black bear conservation projects.

4.4 Project standard measures and publications

See Annexes 4 and 5.

Publication: a leaflet was written and designed and circulated to the stakeholders, and is ready to be released at the time of the press release and the first sale of the certified plants. The purpose of the leaflet is to enhance the “feel good” factor for consumers of the certified plants and to educate them in the certification process and the use of funds raised through the sales. Two peer reviewed scientific papers have been published. The technical manual and stakeholders’ reports are available on the website. Additional scientific publications directly arising from the project work are in prep (see below). One will describe the development of DNA certification, to be released at the same time as the plants are launched to market. We anticipate that this paper will have a significant impact on the conservation of traded plants. An account of the use of matK to barcode Cacti is already ready for submission.

4.5 Technical and Scientific achievements and co-operation

There are plans for further publications over and above those directly arising from the project’s stated aims, these co-authored publications reflect the technical and scientific collaboration stimulated by the project. Because these are not the primary and stated outputs of the project, but have resulted from scientific synergy and opportunity, they will be completed and submitted by the PIs after the project’s end. We anticipate that these publications will have an impact on the disciplines of cactus systematics, biogeography, population biology and conservation. These planned publications include inference of the phylogenetic relationships of the North American species of opuntioids and a proposal for new natural reserves in the Baja California Peninsula based on a phylogenetic diversity analysis. These two are each first authored by exchange students based on data collected in Reading, closely supervised by UK and Mexican PIs. Papers first authored by UK RAs are also in prep. These include an account of the phylogeny of the Cactaceae with reference to patterns of diversity in Mexico, and an account of the patterns of diversity in *Echinocactus grusonii* including assignment of plants in trade to source populations. Finally, the first Mexican exchange student is developing his work on *Ariocarpus bravoanus* to include other members of the genus in Mexico and in trade. He will submit a thesis and publications arising from his work.

4.6 Capacity building

Institution-building has centred on the laboratory, herbarium, living, tissue and DNA collections at UAQ. The Darwin Laboratorium of Molecular Systematics and Evolution was equipped to develop barcodes and produce microsatellites from previously designed primers. The laboratory holds the necessary infrastructure to maintain an important collection of silica dried tissues and purified DNA of the majority of the Mexican cacti species. These facilities will be upgraded as new projects develop and new students join to develop their projects. UAQ has now built a new office block to hold the duties of the botanic garden and part of the Darwin Lab will extend to the new facilities to increase the space and the collection of scientific materials.

The project represented first experience for the Mexican PI in international project management. As well as enhancing his technical and scientific skills and knowledge, he has received valuable experience in project management which will increase his opportunities to present realistic and fundable future projects nationally and internationally. His team (the exchange students) have also benefitted considerably in this regard, and they have fed back to other students and staff in UAQ to consolidate knowledge in the institution.

The relationship with PROFEPA which has arisen out of the stakeholder process works to secure a role for the UAQ team in future initiatives to use genetics in conservation projects. It also increases knowledge of genetics amongst key members of the authorities, presenting Mexico with the opportunity to be at the leaders internationally by embedding these technologies in a legislative framework.

The UK capacity has been significantly enhanced in terms of the UK PI's knowledge and experience of implementing CBD. The UK PI has also furthered her experience of international project management.

4.7 Sustainability and Legacy

Our project showed that certification was feasible, but the certified plants haven't yet been brought to market. Therefore the real test of certification – whether trading certified plants can alleviate the pressure on wild populations and facilitate fair sharing of the benefits of trade – hasn't been carried out. Both the UK and Mexican partners are fully committed to seeing plants brought to trade. The larger the trade in certified plants, the greater the benefits to Mexico. Once a market for certified plants is established, the distribution of benefits arising from the trade will continue as long as plants continue to be sold. Existing NGOs will play a role in the dispersal of funds for conservation purposes and to secure livelihoods in rural communities. The scale of the benefits realised by the project depends on the scale of the market. If consumers have no interest in buying certified plants, or if growers have no interest in producing or selling them, then certification will not have a long-lasting impact in the host country. However, if the launches generate sufficient demand for certified plants, then growers will want to exploit the demand and established trade will provide benefits in a sustainable, long term way.

Aside from the benefits of fair trade, which remains to be established, there are many project achievements which are already tangible and which will endure. The collection of materials, silica dried tissues, herbarium vouchers and all the accessory collections such as seeds, living plants, photographs and databases, have already increased previous knowledge on the distribution and conservation status of the Mexican cacti species. These permanent records of the biodiversity will be useful for present and future generations of researchers and students interested in cacti and biodiversity in general. We have fully secured the permanence of these records for future generations including the voucher materials in public herbaria (QMEX, in Queretaro and MEXU, the National Herbarium of Mexico, UNAM), the living collection and accessory collections in a botanic garden. The sequences produced in this project will be uploaded to public genetic databases (Genbank and EMBO) once the research papers are accepted for publication.

The established Darwin laboratory is also a permanent facility which will contribute to the ongoing scientific activities of the Mexican PI as they relate to this and to other projects. In terms of activities which relate to the Darwin Initiative project, the lab and the botanic garden will join efforts to develop forensic projects with the Mexican environmental authorities

(PROFEPA) to identify cacti species and reduce illegal trade on cacti. The Mexican PI is currently developing an MoU to develop these projects with PROFEPA and together will submit proposals to enhance and run the Darwin Lab. We hope these kind of collaborations will make the Darwin Lab fully sustainable and autonomous in securing future funding to continue its research goals.

We anticipate that the relationship between UK and Mexican PIs will continue. The Mexican PI is well-established at UAQ, where he continues to manage the Darwin lab as well as the Botanic Garden. The UK PI will continue to work at the University of Reading, and is actively seeking resources to develop work on Mexican desert cacti further, in collaboration with the Mexican PI. In the immediate future, as well as keeping in touch because of their shared determination to see certified plants brought to market, the UK and Mexican PIs will continue to work together to secure the publication of scientific papers arising from the work carried out. We hope that Mexican exchange students (Victor, Beto and Luz) will also continue to be involved in the work. For example, Victor is a PhD student in Reading, and is co-supervised by the Mexican and UK PIs – his ongoing work will bind the teams together. Luz is planning to work either in the UK or in Mexico, where her skills will be directed towards deeper understanding of Mexican biodiversity. In contrast, Beto and the UK RAs have moved on to other projects, or plan to, though all are continuing to work on publications arising from the work.

5 Lessons learned, dissemination and communication

We learnt three main lessons – these relate to the biggest challenges we faced in delivering the project objectives.

1. We learnt that our fieldwork schedule was too ambitious. Because of safety considerations in the desert at least two people should work together in the field. We had employed one Mexican technician on the project anticipating that the project's Mexican PI would be available to accompany him in the field. This wasn't the case, because we hadn't adequately ensured that the PI would be free from his other responsibilities at UAQ. Once we had to try to reschedule fieldwork sessions we faced problems with the climate - it was dangerous to work in high summer temperatures, so we had a very curtailed working days, collecting only at dawn and dusk. We should have 1. considered combining herbarium and field sources of plants from the beginning, focussing fieldwork on the plants that were difficult to access from existing collections. 2. Either been very explicit about the Mexican PIs responsibilities to carry out fieldwork in the MOU, or employed two technicians that could work together.

2. We learnt that the duration of our stakeholder meetings as indicated in the project application was far too long. There were few stakeholders who were willing or able to commit to more than one day of meetings, and so for our first meeting we had different people attending on the different days, and people attending perhaps for just a half-day. This was a particular issue with representatives of government bodies. After the first stakeholder meeting we found it easier to maintain the dialogue by scheduling more informal one-to-one meetings, and by visiting local communities when carrying out fieldwork. The scheduling of the second meeting suffered because the UK PI was not able to travel (pregnancy and baby born just before the second meeting due), and it was difficult to get government officials interested in more than a short meeting. We should have 1. Scheduled a shorter first meeting so that we could have everyone attend all of the first meeting. 2. Planned to use one-to-one meetings as a way of continuing dialogue. 3. Instead of a second stakeholder meeting, held a conference to report to a broader range of potentially interested people than those originally directly involved as involved stakeholders. We have discussed a future international conference as a means to bring together other projects to share experiences. Since the initiation of our project there have been new initiatives which share the ethos of our project, though they do not use DNA certification. For example FFP, the Fair Flower Fair Plants organisation which is an international alliance of trade unions, non governmental organisations and international flower trade organisations that have all reached an agreement on the standards and procedures for fair trade in cut flowers and pot plants, and the world's first fair trade nursery, the "Fair Plant Nursery" in South Africa. Something of this kind was not possible with the allocated budget of £275 for our second stakeholders' meeting.

3. We learnt that the roll-out time for any project which relies on growing plants is necessarily beyond what can be achieved in a three-year project timeframe, and that therefore we were right to emphasise laying the groundwork for future legal and CBD-compliant trade. Our plants are still very small, so we aren't ready yet for a launch! We should have directed more resource early on to propagating and growing the plants we the certified genotypes.

In terms of the projects objectives, we learned some very important lessons. We learnt that there is enthusiasm for a DNA-certification scheme. That in the first instance there is more enthusiasm for an opt-in certification scheme, rather than a forensic punitive approach. Technically the certification approach is possible, at least for the two plants that we focussed our fingerprinting research on. Also, we learnt that the barcoding regions we selected were not able to distinguish every species of Mexican desert cactus – and so more work is needed to develop tools for species identification.

In terms of dissemination, we are determined to launch our certified plants to market and are seeking funds to support the launch. We want to capitalise on the interest generated by the project to date to maximise the returns to Mexico from legitimate trade.

5.1 Darwin identity

We have publicised the Darwin Initiative at scientific meetings, referring to the initiative in verbal presentations, and using the logo in the PowerPoint presentations we made and in the posters we presented. We also used the logo as widely as possible, and it is found prominently on our website, on business cards that we had printed at the beginning of the project and on the herbarium labels attached to the specimens which will be seen by all users of the herbarium specimens in the future, both visitors to UAQ and if the specimens are loaned to other institutions. In UAQ, the Darwin Initiative supported molecular lab is identified with a prominent sign on the door as the Darwin Laboratorium of Molecular Systematics and Evolution. All our peer-reviewed scientific publications acknowledge the support of the Darwin Initiative, and our own reports use the Darwin Initiative logo on their front pages. These reports are available on our website.

Whilst we didn't have control over how our work was reported in the media, we were able to secure mentions of the Darwin Initiative in several publications, eg Plant Talk and The Plantsman. We have made links to websites or uploaded pdfs of these articles on our website, so that they are more widely disseminated.

The project was a distinct one, with its own identity. None of the work which was carried out had been initiated prior to the funding being made available, and whilst our longer-term objectives are to build on the work carried out to create a self-sustaining body with wider objectives, in the time-frame of the project we have worked within the project's remit.

Understanding of the Darwin Initiative is embedded in the academic institutions that we have worked with. Our other stakeholders have also gained good understanding of the Initiative because the first presentation made at the first stakeholders' meeting outlined the Darwin Initiative's work. We found that there was a lot of interest in the Initiative from the academic stakeholders in particular. Media interest in our project has come particularly from the horticultural community, a group that perhaps had low awareness of the Darwin Initiative. We hope that awareness of the Initiative has been raised at the same time that growers have been alerted to the implications of the choices they make when they buy plants.

6 Monitoring and evaluation

There were no major changes to the project's logframe. The most significant changes to the submitted project plan relate to the timing and duration of stakeholders' meetings and fieldwork and the location of the training course. Changes to the fieldwork schedule meant that herbarium specimens had to be used as sources of DNA for some species. This change to the project's original plan was approved by the Darwin Initiative. Changes to the timing of the second stakeholders'' meeting were necessitated by the UK PI's maternity leave. The Mexican PI was reluctant to host a second meeting without having a detailed discussion with the UK PI about the agenda for the meeting, and so he travelled to the UK for that meeting, which we held at home with a new baby! Having written a constructive agenda the second stakeholders'

meeting was in the hands of the Mexican PI, but it was difficult to schedule at this stage. However, the Mexican PI had maintained dialogue with the stakeholders' attending the first meeting, and had worked to build relationships with them, so the late scheduling and shorter stakeholders' meeting has not compromised the project. The relocation of the training to the UK was also agreed by the Darwin Initiative.

We found the logframe useful at the time we conceived the project, and it lead us to reflect on outputs and purpose in a way that made the project more coherent. After the development phase we found the milestones a more effective way of stimulating internal communication and management, particularly as these had quantitative targets that were fixed in time. The quarterly review of activities which they afforded were a good way of picking up our pace where necessary, particularly as we had set ourselves a very ambitious field and laboratory work schedule. Towards the end of the project we found the logframe valuable again, as it refocused us on the bigger picture. The activities which we established to review our progress against the milestones included quarterly updates (at least – often at busy periods we had monthly updates) on numbers of species and individuals collected, with DNA extracted, with PCR products, with sequences and with ssr markers. We shared a spreadsheet of these data which the Mexican PI developed. As we progressed, we also reviewed our activities in terms of the delivery of training, stakeholder dialogue and preparation of publications. These reviews were by email and Skype.

We would say that the hardest thing to monitor was our spending. We created budget lines in our application which were not those which the University uses. Also, we conflated monies to go to Mexico and monies to stay in the UK into single budget lines. We had to separate these single lines into two to represent the Mexican and UK funds, and so we were working with budget headings which did not correspond to the original application. This made both reporting and monitoring more challenging.

The only written monitoring was the Darwin Initiative monitoring. We found that our reviewer had appropriate knowledge and gave very good advice. Writing annual reports was more useful than the half-year reports. Other monitoring came through presentations given to an internal audience at our respective institutions. The UK PI and RA gave presentations as part of an internal seminar series on three occasions. The Mexican PI also fully participated in his department's internal seminar series. We found these occasions were most valuable in suggesting ways in which the project might develop in the future, and in overcoming technical challenges. Submission of scientific papers for peer-review has also provided opportunity for external evaluation, although the submissions accepted to date have been technical, and so they have not considered the applications of the markers in certification per se. The peer-review of the DNA barcoding paper (prepared, to be submitted) will afford an opportunity for evaluation of the suitability of the tools developed for their purpose i.e. species identification. The real test of our work will come when the certified plants we are growing up are large enough to be sold, and we hold our launch. The extent of the trade in CBD-compliant certified plants is something that will be monitored in the future, through the work of a new certification authority.

6.1 Actions taken in response to annual report reviews

Throughout, the UK PI and the Mexican PI both read the reviews and has Skype meeting s to discuss them. We did not discuss the reviews, as such, with other partners, but where issues were relevant to them we did raise these issues.

The following issues were raised and the following actions taken by the UK and Mexican PIs:

Annual Report 1

In this report the reviewer

- suggested that the markers we were developing for the two selected species could be transferred to additional species. Indeed, this was the case, and our first publication in Molecular Ecology Notes reports on a screen of twenty seven other cactus species. Not all of the markers worked in all of the species, but we have many more primers than are reported in this paper. We believe that a set of ten primers should be used to determine parentage for the purposes of certification, and as and when needed additional

screening of the other primers will be able to yield ten variable primers for certification of other species. However, we have only carried out species-level surveys of genetic variation for the two test species. Species-level surveys can confirm that there are not lots of other wild plants which share the genotype for these two species. We can envisage a situation where localised species are threatened because there are few populations, and that within the populations targeted by illegal traders there is a lot of clonal reproduction. We would want our certified plants to represent a rare genotype. Thus rolling out further species depends on additional fieldwork as well as lab work. However, it is gratifying that transferability of primers is possible over such a broad taxonomic range as we demonstrate here. Our stakeholders recommended prompt certification of newly discovered species, since these are most threatened. Transferability of primers means that when a new species is discovered the bottleneck will be propagating the certified genotypes rather than lengthy lab work to develop new primers.

- sought clarification that we would be training two exchange students in addition to Victor Rodriguez, the technician. We were able to confirm that two additional students were to be trained. They were Alberto Prado and Maria de la Luz Maqueda.
- sought clarification about our spending – we provided clarification in a later report.

Annual Report 2

In this report the reviewer

- asked how we were dealing with the problems in sequencing matK, our barcoding region. We found matK a difficult region to sequence, but our pilot studies showed that it was the region most likely to facilitate species identification. Since our project selected matK for our work, another Darwin Initiative funded project on Costa Rican orchids has shown the region to be effective, and a high-impact publication seems likely to have established matK to a universal barcode. In this way we were lucky with our sequence of choice, although we have had to work hard in developing novel primers to facilitate easy sequencing. Our study shows that whilst matK might be valuable in terms of its discriminatory power, primer design and the identification of universal primers are not trivial. We have drafted a publication – to be submitted as a priority when the UK return to work after her maternity leave at the end of March 2009 – which reports on our findings.
- recommended that we sought permission from the Darwin Secretariat to use the MEXU collection to make up the shortfall in field-collected sequences. We did this, and with permission went ahead to sequence missing species using the collection. Our thanks go to the MEXU curator and to Hector Hernandez who helped us with the collection. We have returned aliquots of DNA to MEXU for all of the samples extracted from herbarium specimens.
- asked whether the UK PI accompany Mexican staff on field trips to make up numbers so that fieldwork objectives can be safely met. The UK PI travelled with the Mexican PI to Baja California where we were able to collect all of the species from the Peninsula which were not already in our collection, with the exception of two species. It was a fantastic trip which gave the UK PI first-hand experience of how extreme collection pressure is on wild populations. We visited rare populations, whose locality had just been published, to find holes in the ground where the plants had been removed. Visiting another site to search out a species of interest we were quickly adopted by a local guide who had taken European collectors to “see” (collect?) specimens.
- again, drew attention to the problems with interpreting the project expenditure table. As we noted in the previous section, the hardest thing to monitor was our spending. We found that preparing the financial reports for the annual reports took longer than writing the rest of the report. We have endeavoured to present detailed expenditure in a clear way in this report.

- made comments on the development of the scheme highlighting questions that needed to be addressed, for example in terms of scalability of the project. We incorporated these questions in the agenda for the second stakeholders' meeting, and took opportunities to discuss them prior to holding the meeting. The reviewer suggested we sought input from Mexican bodies that had been involved in other certification systems, such as CCMSS. Unfortunately we have not done so, and must concede that the development of scheme has become inward rather than outward-looking in terms of seeking solutions. As we suggest in Lessons Learned, above, we have found it challenging to find a balance between involving key players in developing a final framework for the scheme and enabling wider dialogue. Whilst wider involvement is desirable, for the purposes of finalising the framework for the scheme we have taken a narrower approach. If we had our time again we would try to integrate the two approaches more thoroughly, and would seek more funds for stakeholder activities to facilitate the broader approach.

7 Finance and administration

7.1 Project expenditure

awaiting report from University of Reading Finance and Corporate Services Directorate

7.2 Additional funds or in-kind contributions secured

Funds were secured in Mexico from UAQ to the value of £5000, £1000 for computing equipment and £4000 for consumables. The consumables were over and above those requested for the Darwin project for sequencing and fingerprinting, and were used for additional lab work and for tissue culture and glasshouse work. In the original application we had not anticipated the need for tissue culture resources, and as well as providing consumables funding UAQ made a contribution in kind by providing access to and training in two laboratories – a controlled environment facility and the tissue culture lab. Both were used for the propagation of the certified genotypes. In addition, one greenhouse and one shaded house were used for the living collection and the maturation of seedlings.

7.3 Value of DI funding

Without the funds from the Darwin Initiative, none of the work carried out would have been possible. Indeed, the stimulus for the project came from the Darwin Initiative itself. Whilst both project partners, particularly the Mexican PI, were well aware of the conservation challenges raised by illegal trade in Mexican desert cacti, the idea of pursuing a CBD-compliant certification scheme, and complementing that with barcoding to identify the traded plants, came from the close reading of the CBD which the Darwin Initiative prompted. The project's application form stimulated us to think creatively about how CBD objectives could be met, and how UK expertise could be transferred to Mexico to this end. We think it is fair to say that the project would not have been conceived without the Darwin Initiative, and that without the Darwin Initiative it couldn't have been carried out.

Supporting documents

The pdf includes

Plate 1 Page of the leaflet for consumers

Plate 2 Page of the leaflet for consumers

The two pages of the stakeholders are printed back-to-back and then folded twice to produce a leaflet with the panel headed “If plants could talk…” on the front the cover and the panel “for more information” on the back cover. The leaflet will be sent to the Darwin Initiative to be approved before being circulated to consumers as part of the launch of certified plants.

Plate 3 Certified plants in tissue culture

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

Project summary	Measurable Indicators	Progress and Achievements of the project	Actions required/planned for next period
Goal: 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 • The conservation of biological diversity, • The sustainable use of its components, and • The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources		The project was able to attract the attention of environmental authorities that saw a powerful and scientific way of tracking down illegal trade in endangered wild species of flora and eventually of fauna. We also raised awareness of rural communities while developing fieldwork and showing that the species living in their "backyards" were a source of wealth and an important link with their quality of life. We have produced the most complete analysis, phylogeny and geographical distribution maps of one of the most endangered plant families in world. This knowledge will redirect conservation efforts in Mexico in order to protect the cacti in their natural habitats will filling the up to now empty niche of "fair traded" species in the market.	Not applicable
Purpose This project aims to support the conservation, sustainable harvest and use of Mexican desert cacti, whilst ensuring that the various stakeholders get a fair and equitable share of the benefits arising out of their exploitation by the horticultural trade. A DNA-	• dialogue between stakeholders initiated and ongoing • dialogue informed by technological developments and research findings for targeted cacti • development and implementation of a DNA-based CBD and CITES compliant certification scheme supported	• Two stakeholder meetings were held, and stakeholders attended. The report on the first meeting is available on line while the results of the second meeting were used in the planning of the post project. • DNA tools are established so that they can be used for forensic and	Not applicable

based CBD and CITES compliant identification and certification scheme for nursery-propagated, traded cacti will be identified in consultation with stakeholders and policy-makers, and the DNA fingerprinting technologies in support of the scheme will be developed and implemented in Mexico.	by DNA-based identification tools	certification purposes	
Output 1. Report on methodology/policy for certification, outlining problems and possible solutions	stakeholders' report prepared		
Activity 1.1 stakeholders' meetings		two meetings held; ongoing discussions between first and second stakeholders' meetings and technical progress used to develop agenda for second meeting.	
Activity 1.2 writing of agendas and reports		stakeholder report for first meeting written and circulated	
Output 2. Collection of tissue and DNAs for development and testing	field and lab work make DNA available		
Activity 2.1. fieldwork		carried out as far as possible; herbarium specimens used to source DNA of missing species; sufficient material available for the development of ssrs and barcodes	
Activity 2.2. herbarium and labwork		species collected determined with reference to herbarium collections, voucher specimens prepared with associated notes, photgraphs, silica gel material etc. DNA extracted and banked.	
Output 3. Low cost, robust DNA technologies developed and transferred	new knowledge on sequence variation and SSRs in Mexican desert cacti and appropriate fingerprinting tools methodologies developed ; manual prepared		
Activity 3.1. development of ssr markers		ssr markers developed for *Ariocarpus bravoanus* and *Echinocactus grusonii*; markers shown to be sufficient to identify certified individuals, provenance and parentage and to be transferable to other species	

Activity 3.2. development of barcodes		matK shown to be powerful barcode region for the identification of Mexican desert cacti, though not sufficiently powerful for 100% species identification
Output 4. University-level training	courses and training exchanges equip 3 Mexican scientists to take project forward in Mexico	
Activity 4.1. supervised training and labwork in Reading		three exchange students and the Mexican PI trained in Reading
Activity 4.2. attendance atmolecular systematics intensive course, 10 days		three exchange students attend molecular systematics intensive course in Reading
Output 5. Peer-reviewed scientific publications	scientific publications prepared	
Activity 4.1. preparation of manuscirpts		following manuscripts prepared: ssr development for *Ariocarpus bravoanus;* ssr development for *Echinocactus grusonii;* PD in Baja California using matK sequences generated by project; matK barcode for cacti; population genetics of *Echinocactus grusonii*; cactus phylogeny
Activity 4.2. submission and response to peer review		two papers describing ssr development for *Ariocarpus bravoanus* and for *Echinocactus grusonii* published; paper describing PD in Baja California sent to review and other papers yet to be submitted.
Output 6. Information leaflet	leaflet prepared	
Activity 5.1. writing and design of leaflet		leaflet ready to use when approved by Darwin and when plants are ready for launch

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

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Goal: **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** • **the conservation of biological diversity,** • **the sustainable use of its components, and** • **the fair and equitable sharing of benefits arising out of the utilisation of genetic resources**			
Purpose to support the conservation, sustainable harvest and use of Mexican desert cacti and to ensure stake-holders get a fair share of benefits arising out of exploitation by the horticultural trade	• dialogue between stakeholders initiated and ongoing • dialogue informed by technological developments and research findings for targeted cacti • development and implementation of a DNA-based CBD and CITES compliant certification scheme supported by DNA-based identification tools	• stakeholder meeting held, and stakeholders attend; follow-up identifies way forward in light of technological and scientific developments • field and molecular research carried out • low-cost, robust, reliable and reproducible fingerprinting methods for identification of species and genotypes developed and implemented in Mexico	• stakeholders were able to attend meetings, *though not for long meetings, and not all stakeholders* • safety of fieldwork in Sonoran border regions was such that fieldwork was possible there • UK and Mexican staff were available, *but not to meet the full fieldwork schedule, therefore herbarium specimens were used to source DNA*. UAQ continued to maintain laboratories, and access to herbaria in MEXU and UAQ was possible
Outputs • report on methodology/policy for certification • collection of tissue and DNAs for development and testing • low cost, robust DNA technologies developed and transferred • university-level training • peer-reviewed scientific publications • information leaflet	• stakeholders' report, manual and scientific publications prepared • field and lab work make DNA available • new knowledge on sequence variation and SSRs in Mexican desert cacti • appropriate fingerprinting tools methodologies developed • courses and training exchanges equip 3 Mexican scientists to take project forward in Mexico	all publications available in hardcopy and electronically, *except where journals require subscriptions* database of material collected and extracted sequence data exploited as SSR and *barcode* markers implemented in Mexico *3* Mexican scientists awarded10 European Credits each for intensive course; training exchanges happen	suitable technician and exchange scholars were identified and employed fieldwork successful, *but also supplemented by herbarium collected material* permissions already granted to sample from herbarium specimens extended DNA extraction methods already developed in Reading for Opuntioid cacti are applicable across other groups
Activities 1. Stakeholders' meetings. 2. Field and laboratory work. 3. Courses and training. 4. Reports, publications and publicity.		**Activity Milestones (Summary of Project Implementation Timetable)** 1. 2005/09 and *end of project*. 2. Ongoing; completed 2008/06. 3. In UK: 2006/03-09, 2008/10-12 and 2006/10-12. In Mexico 2007/08.4. Stakeholders' report 2006/06; manual 2008/09; leaflet 2008/09; electronic web-based identification tool 2008/09; press releases 2005/11 and 2008/11; peer reviewed scientific papers submitted by 2008/09.	

Annex 3 Project contribution to Articles under the CBD

Project Contribution to Articles under the Convention on Biological Diversity

Article No./Title	Project %	Article Description
6. General Measures for Conservation & Sustainable Use	20	Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring	5	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	5	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	5	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	10	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	20	Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	5	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	10	Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound

Article No./Title	Project %	Article Description
Resources		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 Technology	10	Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair 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	10	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		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)
Training Measures		
1a	Number of people to submit PhD thesis	Two. Victor Rodriguez was the first Mexican technician to visit reading for training (5 months). He returned to Reading in October 2007 to register for a PhD under the joint supervision of the UK and Mexican PIs. In Mexico, Monica Figueroa is registered for a PhD under the supervision of the Mexican PI, her PhD project is possible because of the availability of the Darwin laboratory.
1b	Number of PhD qualifications obtained	None.
2	Number of Masters qualifications obtained	Sawako Sakai was trained alongside victor Rodriguez when he was the Darwin technician being trained in Reading. She was a self-funded MSc student on the Reading MSc in Plant Diversity, and submitted an MSc thesis based on the work she carried out collecting and analysing sequences from Darwin collected plants.
3	Number of other qualifications obtained	Three Mexican students attended the Reading Intensive course in Molecular Systematics, which is a registered course which awards 10 ECTS points.
4a	Number of undergraduate students receiving training	Three. Alberto Prado, who was the third Mexican trainee, returned to Mexico to develop his studies and submitted that study as partial fulfilment of his undergraduate degree. Two UK students studied cacti using material collected under the auspices of the Darwin project for their undergraduate projects at the University of Reading.
4b	Number of training weeks provided to undergraduate students	24 weeks. Alberto Prado, 3 months. Two UK students using Darwin materials – 3 months each.
4c	Number of postgraduate students receiving training (not 1-3 above)	Two. Victor Rodriguez; Maria de la Luz Ruiz. NB Victor Rodriguez is mentioned in section 1a and here. This is because his training was separate (January to May 2006) to his PhD registration (from October 2007)

Code	Description	Totals (plus additional detail as required)
4d	Number of training weeks for postgraduate students	40 weeks. Victor Rodriguez, 5 months; Maria de la Luz Ruiz, 5 months.
7	Number of types of training materials produced for use by host country(s)	One, technical manual.
Research Measures		
8	Number of weeks spent by UK project staff on project work in host country(s)	8 weeks. UK PI, 5 weeks. UK RA1A, 3 weeks.
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	One. Stakeholders' report.
11a	Number of papers published or accepted for publication in peer reviewed journals	Two.
11b	Number of papers published or accepted for publication elsewhere	Two.
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	Three. One database of DNA sequences for species identification. One database of microsatellite data for *Ariocarpus bravoanus*; One database of microsatellite data for *Echinocactus grusonii.*
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	One. Species distribution and nomenclatural database.
13a	Number of species reference collections established and handed over to host country(s)	750 new herbarium vouchers, 735 species silica gel collections and 306 population silica collections, 1041 DNA extractions, 1500+ photographs, a small seed collection of approx 40 species, a small cactus wood collection, and a living collection of 150 plants.
Dissemination Measures		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	Two. Stakeholders meetings.
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	Four international (Taipei, Panama, Veracruz and Chihuahua), and 2 short courses at UAQ.
15a	Number of national press releases or publicity articles in host country(s)	Four in Mexico and at least 3 in the US. However, some of these newspapers did not contact the Mexican PI directly and probably just "re-wrote" the words of others.
15b	Number of local press releases or publicity articles in host country(s)	Two in the state of Queretaro.

Code	Description	Totals (plus additional detail as required)
15c	Number of national press releases or publicity articles in UK	Three, Plantsman, Plant Talk and The Garden
19c	Number of local radio interviews/features in host country (s)	Three.
Physical Measures		
20	Estimated value (£s) of physical assets handed over to host country(s)	Ca. £ 20,000.00
21	Number of permanent educational/training/research facilities or organisation established	Four. Molecular lab, living collection, seed bank, DNA bank.
23	Value of additional resources raised for project	£5000 total. £1000 for a computer and £4000 consumables funds.
Other Measures used by the project and not currently including in DI standard measures		
	Enhancing the value of existing laboratories in UAQ by initiating projects in those laboratories and paying for the running costs and consumables used.	Two laboratories – controlled environment facility and the tissue culture lab. Both used for the propagation of the certified genotypes. One greenhouse and one shaded house for the living collection and the maturation of seedlings.

Annex 5 Publications

Type * (eg journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Journal.	Hardesty, B. D., S. L. Hughes, V. M. Rodriguez and J. A. Hawkins. 2008. Characterization of microsatellite loci for the endangered cactus *Echinocactus grusonii*, and their cross-species utilization. Molecular Ecology Resources. 8: 1. 164-167.	Blackwell Publishing	www.wiley.com/bw/journals.asp?ref=1755-098X&site=1	Available by subscription to journal
Journal.	Hughes, S. L., V. M. Rodriguez, B. D. Hardesty, R. T. Bárcenas, H. M. Hernández, R. M. Robson and J. A. Hawkins. 2008. Characterization of microsatellite loci for the critically endangered cactus *Ariocarpus bravoanus*. Molecular Ecology Resources. 8: 5. 1068-1070.	Blackwell Publishing	www.wiley.com/bw/journals.asp?ref=1755-098X&site=1	Available by subscription to journal
Technical Manual	Rolando Barcenas, Julie Hawkins, Victor Rodriguez and Luz Maqueda	Project internet published	www.uaq.mx/ccma	None
Stakeholders' Report	Rolando Barcenas, Julie Hawkins and Denise Hardesty	Project internet published	www.uaq.mx/ccma	None

Annex 6 Darwin Contacts

Ref No	Ref 14-059
Project Title	Certification to support conservation of endangered Mexican desert cacti
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