

## *Darwin Initiative Annual Report*

### Darwin Project Information

|   |  |
|---|--|
| Project Ref Number  | 15/035   |
| Project Title   | <i>Ex situ</i> conservation of the rare and threatened plants of Mauritius   |
| Country(ies)  | Mauritius  |
| UK Contract Holder Institution  | Royal Botanic Gardens, Kew   |
| UK Partner Institution(s)   | n/a  |
| Host country Partner Institution(s)   | Ministry of Agro-Industry & Fisheries, Mauritius<br>Herbarium of the Mauritius Sugar Industry Research Institute, National Threatened Plants Technical Committee |
| Darwin Grant Value  | £60,029  |
| Start/End dates of Project  | 1 Jul 2006 to 30 Jun 2009  |
| Reporting period (1 Apr 200x to 31 Mar 200y) and annual report number (1,2,3..) | 1 Apr 2006 to 31 Mar 2007, annual report number 1  |
| Project Leader Name   | Steve Alton  |
| Project website   | n/a  |
| Author(s), date   | Steve Alton, 27 Apr 2007, with comments from Claudia Baider and Kevin Ruhomaun   |

### 1. Project Background

The project seeks to aid the Government and people of Mauritius in achieving Target 8 of the Global Strategy for Plant Conservation - '*60% of threatened plant species in accessible ex situ collections, preferably in the country of origin*' – through the creation of a wild species Seed Bank. The Seed Bank is located at an existing Government nursery at Robinson Road, Curepipe, taking advantage of a previously vacant building originally intended as offices and a quarantine station. This building was donated by the Mauritian Government as part of their contribution to the project. The facility will house drying and cold storage facilities, enabling the long-term conservation of seeds of Mauritian native plant species. Duplicate collections will be held at the Millennium Seed Bank in the UK, and herbarium specimens associated with the collections at the Mauritius Herbarium, Mauritian Sugar Industry Research Institute (MSIRI).

### 2. Project Partnerships

**Project partnerships:** The partnership originally involved only a single member of staff from the UK lead institution (the Project Leader). As a result of the project this has expanded, with visits from two additional members of staff from the Seed Conservation Department at Kew, and a further visit by a horticulturalist from Kew's Moist Tropics team. This developing relationship represents a two-way flow of material and expertise between the partner countries; as well as seeds being sent to Kew, both seeds and living plants have been repatriated to Mauritius. This is seen as being the model for the future development of the collaboration, with the relevant departments within Kew working together to service the project.

The primary aim of the project is to enable the partner institutions to meet CBD commitments, specifically the *ex situ* target (Target 8) of the Global Strategy for Plant Conservation. This will be achieved through the construction of a long-term seed storage facility, with a lifespan far beyond that of the current project, but also through training and capacity building to allow the on-going maintenance and sustainable utilisation of the conserved seed collections. The facility has the capacity to hold significantly more than the 300 threatened species targeted by this project, and the germination protocols developed by the project will feed into reintroduction and reinforcement programmes. The project is already resulting in an increase in both capacity and networking in Mauritius. In addition to the two staff posts funded by Darwin, a nurseryman and

driver have been recruited by the Government to support the project, and additional administrative support has been provided part-time by a technical officer. Field support for identification and collecting is being provided by a Park Ranger and staff from the Mauritian Herbarium.

The main challenge has arisen from the fact that two of the key partners are departments within larger bodies. The first key step was to agree and sign a Memorandum of Collaboration that would cover material transfer issues and access and benefit sharing. This required the involvement of several other departments within both Kew and the Government of Mauritius. Since the Mauritians were understandably reluctant to commence recruitment of the two staff posts until this legal document was signed, this resulted in a significant but unavoidable delay to part of the project. Fortunately the completion and equipping of the Seed Bank facility at Curepipe was not seen as being dependant on the signing of the MoC, and this work was able to proceed. As a result, when the two posts were finally recruited, the facility was ready and waiting.

Kew is working to ensure that its own departments work together to deliver its part of this and many similar projects. *Ex situ* conservation, for instance, needs to be steered by conservation genetics studies, and species that do not lend themselves to conservation as seeds will benefit from micropropagation or cultivation as living plants. This requires greater communication between horticultural, research and conservation departments within Kew.

**Other Collaborations:** The project benefits from the involvement of the National Threatened Plants Technical Committee, which includes members of a range of organisations involved in plant conservation in Mauritius, particularly the Forestry Service, the Mauritian Wildlife Foundation (an NGO), and the University of Mauritius.

The CBD focal point in Mauritius is the Ministry of Environment, who work closely with the Ministry of Agro-Industry & Fisheries.

### **3. Project progress**

#### **3.1 Progress in carrying out project activities**

##### **Output 1.** Access and Benefit Sharing Agreement (ABSA) developed

Activity 1.1 Although significantly delayed, the Memorandum of Collaboration, which covers access & benefit sharing and material transfer, was eventually signed by all three parties.

##### **Output 2.** Securely banked seed collections of rare and threatened species

Seed collections of 300 species cleaned, processed and divided between partner countries

Activity 2.1. Collection of seeds and associated herbarium samples was entirely dependant of the two project staff members being in post and trained up. This has inevitably been delayed by the late signing of the MoC, but at the time of writing seed collections are beginning to arrive at Kew.

##### **Output 3.** Herbarium specimens held in duplicate herbaria

At least 2 herbarium specimens made for each seed collection, one for each country

Activity 3.1 see 2.1

##### **Output 4.** Germination protocols developed for seed collections

All seed collections tested at MSBP and germination results recorded

Activity 4.1 see 2.1

**Output 5.** Storage protocols developed for all orthodox species  
 Research carried out on species with storage problems

Activity 5.1 see 2.1

**Output 6.** Creation of National seed bank facility in Mauritius  
 Establishment of native species seed bank

Activity 6.1 As has been mentioned already, recruitment was delayed by the late signing of the MoC. Additionally, the successful candidate for the second post (Seed Bank Assistant) later pulled out and the post had to be re-filled. However, both members of staff are now in post and are currently being trained.

Activity 6.2 The facilities at the Native Plant Propagation Centre, Robinson Road Nursery, Curepipe, were completed at the end of 2006 and equipment was shipped out from the UK during the period Jan-Feb 2007. In January the Millennium Seed Bank's Laboratory Manager, Mr. Keith Manger, undertook a visit to Mauritius to supervise the installation of the equipment and to provide training in its use. A copy of Keith's report is included as Annex 3. The list of equipment was adjusted slightly as a result of Keith's visit; the freezers available in Mauritius, for instance, were unsuitable and units had to be shipped in from the UK at considerable additional cost. It was decided, however, that it was important to get the infrastructure right, even if it meant a reallocation of funds, in order to produce the best possible facility.

**Output 7.** Increased capacity in ex situ conservation for Mauritius  
 20 Mauritian Stakeholders successfully trained

Activity 7.1 Keith Manager carried out training for 4 members of staff from Government departments during his visit in January 2007. This represents the first phase of the training programme, with the second phase taking place at the time of writing involving a further 12 trainees.

### 3.2 Progress towards Project Outputs

Despite an initial delay, progress towards the Outputs is now back on track. The ABSA has been agreed and signed by both parties, and the two staff posts have been filled. More importantly, the Seed Bank facility itself has been completed and equipped to a high standard, overseen by the MSB's Laboratory Manager, and will provide a long-lasting resource for biodiversity conservation in Mauritius.

The collection of seeds and herbarium specimens has inevitably been delayed by the late recruitment, but extensive training is taking place at the time of writing, and the pool of trained staff from a range of partner organisations should allow the shortfall in species numbers to be made up within the lifetime of the project.

### 3.3 Standard Output Measures

**Table 1 Project Standard Output Measures**

| Code No.          | Description   | Year 1<br>Total | Year 2<br>Total | Year 3<br>Total | Year 4<br>Total | TOTAL |
|-------------------|---|-----------------|-----------------|-----------------|-----------------|-------|
| Established codes |   |                 |                 |                 |                 |       |
| 6A                | Number of people to receive training from Kew gardens | 4               |                 |                 |                 |       |
| 6B                | Number of weeks for course                            | 1               |                 |                 |                 |       |

|                                 |  |   |  |  |  |  |
|---------------------------------|--|---|--|--|--|--|
| 8                               | Number of weeks spent in Mauritius by UK staff                         | 2 |  |  |  |  |
| 14A                             | Number of seminars in Mauritius  | 0 |  |  |  |  |
| 15A                             | Number of national press releases in Mauritius (if permission granted) | 2 |  |  |  |  |
| 18A                             | Number of TV features in Mauritius                                     | 0 |  |  |  |  |
| 19A                             | Number of radio interviews   | 1 |  |  |  |  |
| 21                              | Number of new facilities established                                   | 1 |  |  |  |  |
| New - Project specific measures |  |   |  |  |  |  |

In Table 2, provide full details of all publications and material produced over the last year that can be publicly accessed, eg title, name of publisher, contact details, cost. Mark (\*) all publications and other material that you have included with this report.

**Table 2 Publications**

| Type *<br>(eg journals, manual, CDs) | Detail<br>(title, author, year) | Publishers<br>(name, city) | Available from<br>(eg contact address, website) | Cost £ |
|--------------------------------------|---------------------------------|----------------------------|---|--------|
| n/a                                  |                                 |                            |   |        |

### 3.4 Progress towards the project purpose and outcomes

The essential groundwork has been completed with the establishment of the Seed Bank facility and the recruitment of the two posts. Once the training has been completed (currently ongoing) everything will be in place for the seed collecting phase of the project. This will make a direct and significant contribution to Target 8 of the Global Strategy for Plant Conservation: *'60% of threatened plant species in accessible ex situ collections, preferably in the country of origin'*. The main assumption – that adequate seed will be available to achieve this – still holds true, and as with any project involving biological systems, this is unpredictable and at the mercy of factors such as climate. It would be wrong, however, to place too much emphasis on numbers of seed collections as a measure of success; the capacity building aspects of the project will allow seed conservation to continue in the future, as well as raising awareness of the need for this work, resulting in a lasting legacy.

### 3.5 Progress towards impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

The project will have a direct and measurable impact on biodiversity, taking germplasm of endangered plant species and placing it in secure storage, both in the country of origin and in the UK. Additionally, the germination protocols developed as part of the curation process will feed into propagation work, enabling reintroduction and reinforcement programmes in the wild. Furthermore, the training given as part of the project will increase the number of people in country with the skills to continue this work beyond the lifespan of this project.

## 4. Monitoring, evaluation and lessons

As has been mentioned earlier, seed collecting is by its very nature unpredictable, being subject to factors such as climate and predation. In addition, a great many of the target species are currently represented by very few individuals in the wild, making the collecting of a useful seed sample even harder. As such, numbers of collections received, whilst a useful indicator of progress, should not be seen as an absolute measure of success. Other indicators of the project' progress – number of staff trained, media coverage, etc – will continue to be monitored and should give a picture of the wider impact.

**5. Actions taken in response to previous reviews (if applicable)**

N/a

**6. Other comments on progress not covered elsewhere**

One particular risk faced by the project is loss of trained staff. There has already been a delay contributed to by a candidate deciding not to accept the post of Seed Bank Assistant; any further losses of staff would result in similar or greater delays as replacements are recruited and trained. The contract for the Seed Bank Technician includes a penalty of 100,000 rupees if the post holder leaves before the end of the contract, to act as a possible deterrent. This risk also applies beyond the end of the project; the continued success of the Seed Bank in Mauritius will depend of continuity of staff, and it will be important to address the problem of funding for the two posts beyond the end of the project period.

**7. Sustainability**

The project has already been covered by the media in Mauritius, particularly radio and newspapers, and visits by Kew staff have helped to raise the media profile. Now that the Seed Bank facility is complete, is anticipated that a launch event will be held, and this will be promoted both in Mauritius and in the UK. A high public profile will be particularly important towards the end of the project, when funds will need to be sought to continue the work. Although the facility itself will be largely self-sustaining, staff time will be needed for on-going maintenance and certainly for any additional seed collecting.

**8. Dissemination**

Dissemination so far has been through the popular media and aimed at a non-technical public audience. Towards the end of the project, when funds will be sought to extend the project, a more specialist audience will be targeted, particularly Government officials. The project has already been promoted at a senior level during visits by Kew staff.

9. .

**10. OPTIONAL: Outstanding achievements of your project during the reporting period (300-400 words maximum). This section may be used for publicity purposes**

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## Annex 1 Report of progress and achievements against Logical Framework for Financial Year: 2006/07

| Project summary   | Measurable Indicators   | Progress and Achievements April 2006 - March 2007   | Actions required/planned for next period   |
|---|---|---|--|
| <p><b>Goal:</b> <i>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</i></p> <p><i>The conservation of biological diversity,</i></p> <p><i>The sustainable use of its components, and</i></p> <p><i>The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources</i></p> |   | The creation of the native species Seed Bank represents a significant contribution towards the conservation of biodiversity in Mauritius. The associated training will enable the sustainable utilisation of the collection held in the Bank. | <i>(do not fill not applicable)</i>  |
| <p><b>Purpose</b> Implementation of Target 8 of the Global Strategy for Plant Conservation (CBD) in Mauritius - '60% of threatened plant species in accessible ex situ collections, preferably in the country of origin, by 2010...'</p>  | Accurately identified samples of seed from 300 native plant species held in long-term secure storage in Mauritius and in UK | The long-term secure storage facility is now complete and operational, and the 2 key staff members are in post. Training is under way and, when this is completed, everything will be in place for the programme of seed collection.          | Extensive training of seed collection and processing staff is currently under way. Species targeting is also taking place. |
| <p><b>Output 1.</b> Access and Benefit Sharing Agreement (ABSA) developed</p>   | ABSA document signed by both parties  | Completed   |  |
| Activity 1.1 MTA signed by both signatories   |   | Completed   |  |
| <p><b>Output 2.</b> Securely banked seed collections of rare and threatened species</p>   | Seed collections of 300 species cleaned, processed and divided between partner countries                                    | Due to delayed recruitment, seed collecting has only recently commenced, though the first collections have now been received.   |  |
| Activity 2.1. Collect seeds and herbarium specimens (300 species, up to 5 replicate populations)  |   | See above   |  |
| <p><b>Output 3.</b> Herbarium specimens held in duplicate herbaria</p>  | At least 2 herbarium specimens made for each seed collection, one for each country  | Dependent on the progress of seed collecting (see Output 2), though the two project staff members have received training at the MSIRI Herbarium on herbarium techniques   |  |
| Activity 3.1 see 2.1  |   | See Output 2  |  |
| <p><b>Output 4.</b> Germination protocols developed for seed collections</p>  | All seed collections tested at MSBP and germination results recorded  | -   |  |

|   |   |  |
|---|---|--|
| Activity 4.1 Produce germination protocols for ca. 100 problem species  |   | See Output 2   |
| <b>Output 5.</b> Storage protocols developed for all orthodox species   | Research carried out on species with storage problems | -  |
| Activity 5.1 Determine storage requirements of those species with storage problems  |   | See Output 2   |
| <b>Output 6.</b> Creation of National seed bank facility in Mauritius   | Establishment of native species seed bank             | Completed  |
| Activity 6.1 Recruit seed technician and assistant  |   | Delayed, but now completed   |
| Activity 6.2 Set up laboratory facilities at the Native Plant Propagation Centre, Robinson Road Nursery, Curepipe (Mauritius) |   | Completed  |
| <b>Output 7.</b> Increased capacity in ex situ conservation for Mauritius   | 20 Mauritian Stakeholders successfully trained        | Good progress made towards the overall target of 20 stakeholders trained   |
| Activity 7.1 Train 2 key Mauritian staff at MSB in seed collecting and processing (UK)  |   | 4 staff members trained in country, 2 project staff currently being trained in country, and will be trained in the UK later this year. An additional 12 members of staff currently being trained in country. |

## Annex 2 Project's full current logframe

| Project summary   | Measurable Indicators   | Means of verification  | Important Assumptions  |
|---|---|--|--|
| Goal:<br><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> |   |  |  |
| Purpose<br>Implementation of Target 8 of the Global Strategy for Plant Conservation (CBD) in Mauritius - <i>'60% of threatened plant species in accessible ex situ collections, preferably in the country of origin, by 2010...'</i> :  | <ul style="list-style-type: none"> <li>• Accurately identified samples of seed from 300 native plant species held in long-term secure storage in Mauritius and in UK</li> </ul>   | <ul style="list-style-type: none"> <li>• List of species held with germination test results</li> </ul>   | <ul style="list-style-type: none"> <li>• Availability of sufficient plant material</li> </ul>  |
| Outputs <ul style="list-style-type: none"> <li>• Access and Benefit Sharing Agreement (ABSA) developed</li> <li>• Securely banked seed collections of rare and threatened species</li> <li>• Herbarium specimens held in duplicate herbaria</li> </ul>  | <ul style="list-style-type: none"> <li>• ABSA document signed by both parties</li> <li>• Seed collections of 300 species cleaned, processed and divided between partner countries</li> <li>• At least 2 herbarium specimens made for</li> </ul> | <ul style="list-style-type: none"> <li>• Signed copies held by both parties</li> <li>• List of collections held</li> <li>• List of herbarium specimens held</li> </ul> | <ul style="list-style-type: none"> <li>• Seed availability not limited for some rare species, and seed storage behaviour not a problem for others</li> <li>• Samples available from all species</li> </ul> |

|  |   |  |   |
|--|---|--|---|
| <ul style="list-style-type: none"> <li>• Germination protocols developed for seed collections</li> <li>• Storage protocols developed for all orthodox species</li> <li>• Creation of National seed bank facility in Mauritius</li> <li>• Increased capacity in ex situ conservation for Mauritius</li> </ul>   | <p>each seed collection, one for each country</p> <ul style="list-style-type: none"> <li>• All seed collections tested at MSBP and germination results recorded</li> <li>• Research carried out on species with storage problems</li> <li>• Establishment of native species seed bank</li> <li>• 20 Mauritian Stakeholders successfully trained</li> </ul>                | <ul style="list-style-type: none"> <li>• Germination protocols held by both partners.</li> <li>• Young plants of rare species propagated in UK and Mauritius</li> <li>• Copies of research reports held by both partner countries</li> <li>• Facility in operation</li> <li>• Number of people receiving training</li> </ul> | <ul style="list-style-type: none"> <li>• Enough seeds available for testing.</li> </ul> |
| <p>Activities</p> <ul style="list-style-type: none"> <li>• MTA signed by both signatories</li> <li>• Recruit seed technician and assistant</li> <li>• Train 2 key Mauritian staff at MSB in seed collecting and processing (UK)</li> <li>• Set up laboratory facilities at the Native Plant Propagation Centre, Robinson Road Nursery, Curepipe (Mauritius)</li> <li>• Train 20 Mauritian stakeholders in seed collecting and basic processing (Mauritius)</li> <li>• Collect seeds and herbarium specimens (300 species, up to 5 replicate populations)</li> <li>• Produce germination protocols for ca. 100 problem species</li> </ul> | <p>Activity Milestones</p> <ul style="list-style-type: none"> <li>• Achieved by June 2006</li> <li>• Appointed by August 2006</li> <li>• Training in August 2006</li> <li>• Started in July 2006</li> <li>• Course held Nov 2006</li> <li>• Annual stock take (July 07,08), final report (Aug 09)</li> <li>• Annual report (July 07,08), final report (Aug 09)</li> </ul> | <p>Assumptions</p> <p>As above</p>   |   |

## **Annex 3 onwards – supplementary material (optional)**

### **In country technical report on the Darwin Mauritius wild seed bank project following a visit by Keith Manger in January 2007**

#### **1. Executive summary**

Although there was an initial delay for this three year project, the project has now gained momentum with a sound network developing in country, recruitment of two key project staff and signing of the MOU with transfer of funds in hand.

A new and very suitable seed bank building has been constructed; a suggested plan has been provided for the internal layout. Key equipment has been imported and all but three items commissioned with basic training provided; the remaining equipment is still delayed in customs or not yet in country.

There is significant local knowledge relating to the 700 native plant species, although the degree of recalcitrance is not known and is likely to be above average. Many of the species are extremely rare, endemic and endangered. A detailed species list is critical to early delivery of the project goals, a draft primary list has been provided.

Training is perhaps the most important issue to address, the two new staff will be effectively running the project and although highly suitable, lack hands on seed collecting or curation experience. In addition, the broader network also needs in-country training via a workshop especially with regards to seed collecting.

There are currently no laboratory germination facilities, though high quality nursery facilities are on site with limited staff support. The germination and subsequent growing of especially rare species is seen as a major MSBP contribution. Reintroduction of UK grown plants needs to be considered.

There is currently no in-country storage facilities for recalcitrant / intermediate species, protection of these species will currently need to be as plants via the nursery.

#### **2. Introduction**

The visit had the following key objectives:

1. Supply, commission and train on agreed equipment (see appendix 1 – equipment list).
2. Design and recommend layout of the “National Parks and Conservation Service’s” new seed bank building located at the Native Plant Propagation Centre at Curepipe.
3. Assist with procurement of in country equipment purchasing.
4. Assist with any customs clearance issues.
5. Assist with the transfer of first year funds to the agreed bank account.
6. Meet key stakeholders of the project and report back current and proposed developments.

This project is part Darwin funded, it is a three year project from the date of signing of the MOU which should be signed by the end January 2007. The three partners are the Royal Botanic Gardens Kew (Millennium Seed Bank project), the National Parks and Conservation Service (NPCS) -Ministry of Agro-industry Government of Mauritius at Réduit and the Mauritius Herbarium (Mauritius Sugar Industry Research Institute) also at Réduit.

Kevin Ruhomaun of the National Parks and Conservation Service is the co-ordinator in country, the Darwin project being one of several he is involved with. He is an enthusiastic and knowledgeable project manager with a forest conservation back ground. Within the MSBP Steve Alton is the project co-ordinator.

The aim of the project is to collect seeds and herbarium specimens from at least 300 native wild species over three years; and subsequently develop germination protocols and therefore aid recovery programmes.

### **3. New Seed Bank building**



This new single storey building is of a high quality; it has an adjacent mess room and is currently unfurnished. Power, lighting and plumbing are installed and functional. The site does not suffer from earthquakes, floods or volcanic activity and has a reliable power supply, a generator is listed on the cash flow). The site like the rest of Mauritius is prone to occasional severe cyclones, the building has been constructed to withstand these. The site is secure with security guards present.

**Kevin Ruhomaun and site nursery technician**

The interior, though unfurnished, is well finished with a tiled floor and good natural light. Currently it is a single room measuring circa 8.2m square with one central support. It is intended that this space be used for seed cleaning, seed banking, germination testing and general applied science as well as offering office facilities for the two new staff.



Secure storage of equipment and consumables will also be required. A suggested plan for the interior of the building is attached (appendix 2). The plan basically segregates the interior space using a part glazed stud partition; it shows location of power points and new benches. Active ventilation and / or air conditioning may need to be considered.

The building should be completely fitted out and functional by the end of March 2007.



The site also has good nursery facilities including external shaded enclosures and a high quality greenhouse with heated benches and misting units.



It is aimed to grow native species in the surrounding gardens ultimately opening them to the public.

### **3. Equipment**

Equipment as per appendix 1 has been purchased by RBGKew (Darwin funds) and sent to Mauritius. The equipment is specified to be sufficient for purpose for this project. Should the project expand beyond the current terms of reference, the freezer capacity and in particular the drying capacity will need to be re considered. The Rotronic system, microscope, heat sealer and other items have been delivered, commissioned and basic training undertaken. The Agriculex seed blower and balance are stuck in customs whilst the incubator has still not arrived in port.

Despite considerable efforts to purchase freezers in country, no units of a suitable specification were available. A UK quote for export of suitable freezers has been actioned to move this issue forward. If the freezers are exported from the UK, funds originally listed in the budget as Mauritius spend will need to be transferred as UK spend.

Other equipment has also been purchased by NPCS in accordance with the budget including a PC for the seed bank. The Herbarium is currently obtaining quotes for two herbarium cabinets and will undertake purchase of other items once finances have been transferred from Kew.

It is anticipated that all equipment will be purchased and in place by the end of March 2007.

### **4. Seed collecting and climate**

There are approximately 700 native plant species on Mauritius of which 311 are endemic (60 of which are severely threatened or considered extinct). There are circa 12 palm species and circa 50 orchid species on the list. Many collections may have low seed numbers due to plant rarity and high level of invasive alien species.

Mauritius is a sub-tropical island whose temperature ranges from 16°C to 30°C whilst the Relative Humidity (RH) ranges from 62 to 78% RH (see appendix 3).

Although a species list exists, this needs to be urgently re-examined and prioritised with regards to seed collecting. It is critical that the storage

behaviour of seeds on the list is established by reference to any available literature including the MSBP's Seed Information Database (SID). This list should also indicate the rarity and location of species populations if known. SID was demonstrated during the visit. Priority should initially be given to the collection of orthodox species, as these can be processed and stored in a more flexible manner. Currently there are severely limited facilities and



**Kevin and Mario Allet, a ranger at Black River Gorge National Park**



insufficient staff capacity both in Mauritius and in the MSBP to properly deal with large numbers of recalcitrant species.

Any very rare plant species sent to the MSBP will require all resultant seedlings to be grown on in the MSBP nurseries. The ultimate use / repatriation of these plants will be dealt with on a case by case basis. Germination protocols are seen as a key output of this project. Currently, the Mauritian partners only have nursery facilities. Consideration may be given to the development of laboratory based germination facilities for the future though this will require a minimum of £10,000 additional funding.

It is expected that herbarium and forestry staff will assist with seed collecting and deal with herbarium specimens and verification.

Based on MSBP experience, 275 units of time / money are spent seed collecting compared with 70 units for seed processing and only one unit for long term storage. Similarly, an experienced team of four

collectors may expect to collect four high quality seed collections per day on average. Based on these figures a collecting target of 100 collections per year will require a minimum of circa 25 seed collecting trips, this excludes increased time associated with duplicate collections.

## **5. Staff and training**

Two new staff have been interviewed and offered posts; these staff will hopefully be in place by mid February / early March. Both are female Mauritian students from the local University, with field experience and are thought to be very suitable candidates. Early training of these individuals is key to rapid progress of this project, as neither have experience with wild plant seed collection, processing or banking.

The 'seed technician' post will run the seed bank and is proposed to receive formal training at the Millennium Seed Bank as soon as possible. The 'assistant' post will support the seed technician with all these activities and will also receive training by MSBP staff either in the UK or in Mauritius. The most urgent training relates to seed collecting; consideration might be given to in- country training by way of a joint seed collecting trip involving an experienced MSBP seed collector. Additional training for key Mauritian partners especially relating to seed collecting will be delivered via a work shop in 2007.

## **6. Database**

The Mauritian Herbarium already uses 'Brahm's' and it is considered that the seed bank should link to this existing facility. It is important that the unique Mauritian accession numbers are used from the beginning of seed collecting.

## **7. Finances**

The MOU has been signed and is on its way back to Mauritius. The Project will run for 3 years from the date of signing. However, the Darwin funding runs per financial year and the first years funding ends 31<sup>st</sup> March 2007. Clarity needs to be sought as to whether Darwin will consider a change in start date from the signing of the MOU, otherwise there is the possibility of losing some of the Darwin funding due to initial delays with the project.

Although significant Darwin funds are currently being transferred from Kew to the designated project account, it is likely that an overall project under-spend will exist, especially relating to the late appointment of the two staff detailed above.

## **8. Visit to Plant Genetic Resource Centre, (Guiepipe)**



The laboratory at Curepipe processes cultivars of Mauritian grown agricultural seed. It holds circa 500 frozen accessions. Seed is manually cleaned. There is some high quality and well maintained equipment including Bosch freezers, Binder oven and incubator, foil bag heat sealer and Sartorius moisture analyser. Critically, no drying facilities are available, all seed is ambient dried prior to freezing. Ambient conditions rarely drop below 60% RH. Freezing seed at this RH level will severely compromise long term storage.

**Mr Yacoob Mungroo at PGRC**

## **9. Meeting with Senior Chief Executive, Ministry of Agro Industry and Fisheries**

Mr M Puttoo, Acting Director of National Parks and Conservation Service and Keith Manger met with Mrs Krishnawteeb Beegun to discuss the new wild plant seed bank. Mrs Beegun appeared to be enthusiastic about the new seed bank and considered it had a potential place with the preservation of medicinal plants (including local knowledge on use and application) and forestry species. The agricultural seed bank mentioned above was discussed and a link to the new seed bank suggested.

Mrs Beegun intimated that public opinion swayed towards obviously useful plants rather than wild plants.

Keith briefly explained the project, its goals, stakeholders and funders. The fact that the bank's mission will address target 8 of the GSPC and that seed will be being banked to International standards was emphasized. Mrs Beegun was glad the Herbarium was involved and that the project appeared to be developing a strong network.

Mrs Beegun offered a new government draft policy on seed security for Kew's comments. She suggested that this policy might safeguard elements of the Seed Bank's work in Mauritian law.

Mr Puttoo raised his concerns about the loss of the trained staff and inherent experience unless funds were made available beyond the current three years.

## **10. Conclusion / actions**

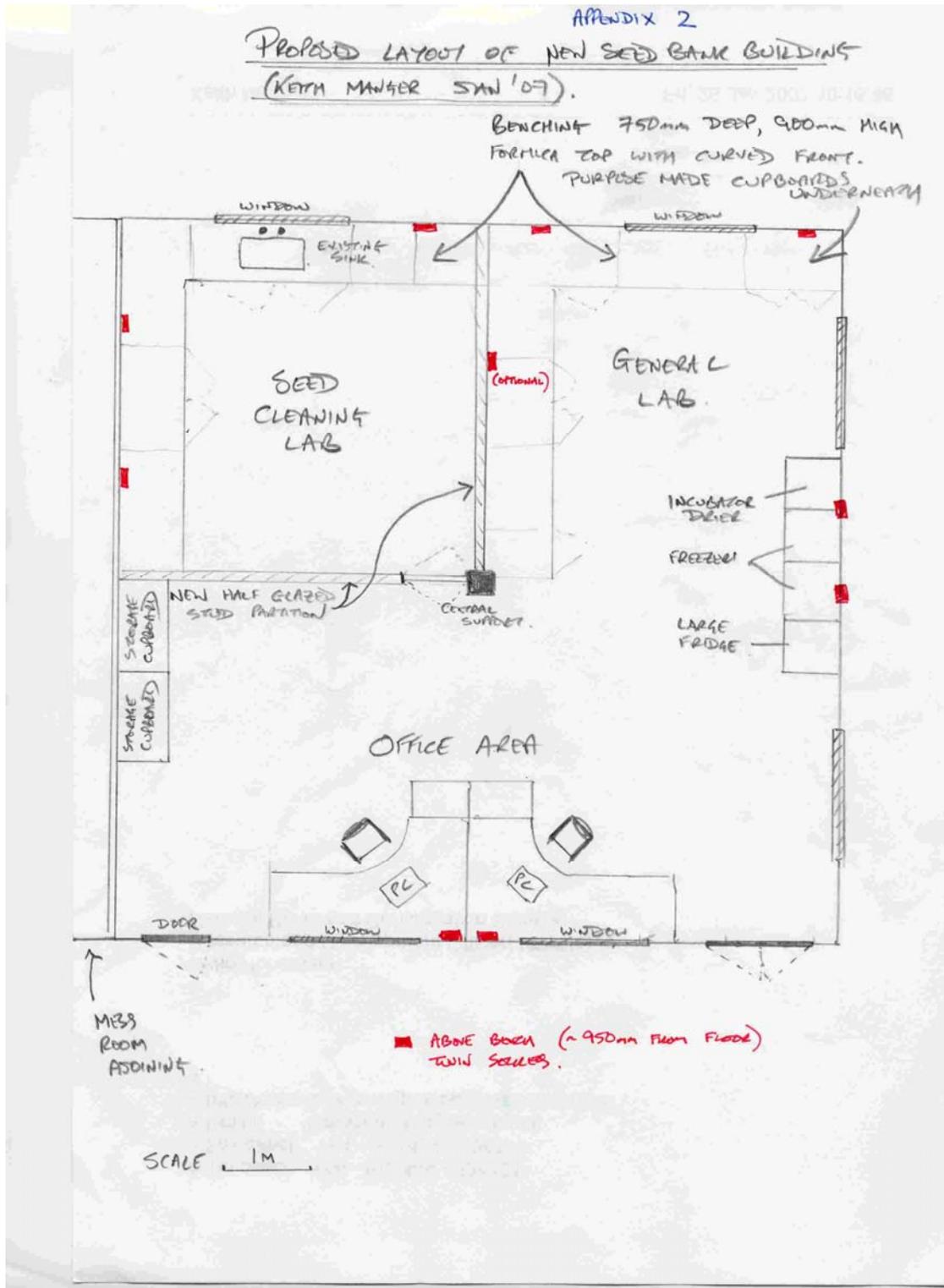
1. All six objectives were either fully or partly met.
2. **Action:** Steve Alton / Keith Manger / Kate Gold to urgently agree training requirements for this project.
3. **Action:** Steve Alton / Mauritian partners to urgently produce species list for collecting targeting.
4. It is worth considering a name plaque for the building recognising and incorporating logos of the various partners and sponsors. To this end an official opening and MSBP article in Samara may give much needed publicity.
5. Based on the likely provision to the MSBP of very rare plant seeds with a higher than average incidence of recalcitrance, it is critical that Research and horticultural staff are engaged and support clarified and agreed. **Action:** Steve Alton / Keith Manger to discuss and agree support from key MSBP staff relating to recalcitrant seed work and nursery growing of rare plants.
6. **Action:** Keith Manger to provide 4 sets of straps to Herbarium.
7. **Action:** Steve Alton / Keith Manger to set up Darwin Mauritius folder on T drive for key documents.
8. **Action:** Keith Manger to organise procurement and export of two freezers and possibly a fridge.
9. **Action:** Keith Manger to discuss conditions for safe short term storage of recalcitrant seed in Mauritius with Dr Hugh Pritchard.
10. **Action:** Steve Alton / Keith Manger to clarify use of existing Brahms database in Mauritius.
11. **Action:** Keith Manger to establish whether DHL can safely export live plant specimens.
12. Following discussions with the project team, Keith suggested that all efforts should concentrate on achieving a wild plant seed bank of Mauritius working to international standards by 31/03/07. It is going to be key to the status and therefore subsequent funding of the project that the project delivers its agreed goals. The potential inclusion of the island of Rodrigues was discussed; Keith recommends that this should definitely be considered but only when the seed bank has an established track record in terms of physical infrastructure, staff and delivery of existing targets.

**Appendix 1 - equipment list**

|    | Item description                        | Unit cost<br>£ (GBP) | Quantity     | Total cost<br>£ (GBP) | Total cost<br>MR  |
|----|---|----------------------|--------------|-----------------------|-------------------|
| 1  | Secateurs (Felco No 20)                 | 23.00                | 2            | £46.00                | 2,853.38          |
| 2  | Hand lens                               | 16.04                | 2            | £32.08                | 1,989.92          |
| 3  | Cloth bags (small)                      | 0.41                 | 200          | £106.00               | 6,575.18          |
| 4  | Cloth bags (medium)                     | 0.56                 | 200          | £134.61               | 8,349.86          |
| 5  | Set of sieves                           | 50.00                | 6            | £286.00               | 17,740.58         |
| 6  | Bungs for sieves                        | 6.19                 | 2            | £12.38                | 767.93            |
| 7  | Sieve brush                             | 10.90                | 1            | £10.90                | 676.13            |
| 8  | Foil bag sealer                         | 502.50               | 1            | £502.50               | 31,170.08         |
| 9  | Dissection kits                         | 25.00                | 2            | £50.00                | 3,101.50          |
| 10 | 3 Place balance                         | 1,030.00             | 1            | £1,030.00             | 63,890.90         |
| 11 | Steroscope with light                   | 1,174.00             | 1            | £1,174.00             | 72,823.22         |
| 12 | Agriculex seed aspirator inc delivery * | 1,381.00             | 1            | £1,381.00             | 85,663.43         |
| 13 | Incubator drier inc delivery *          | 3,500.00             | 1            | £3,500.00             | 217,105.00        |
| 14 | Rotronic relative humidity monitor      | 541.55               | 1            | £541.55               | 33,592.35         |
| 15 | Foil bags (Small)                       | 0.22                 | 200          | £44.00                | 2,729.32          |
| 16 | Foil bags (Medium)                      | 0.85                 | 200          | £170.00               | 10,545.10         |
|    | <b>Notes:</b>                           |                      | <b>Total</b> | <b>£8,223.05</b>      | <b>510,075.79</b> |

\* Except these two items goods will be sent via DHL from the MSBP with duty paid. These two items will require in country customs clearance and inspection prior to accepting delivery ( duty may need to be paid).

## Appendix 2 – Proposed laboratory plan



## Appendix 3 – Environmental data

Appendix 3

### INDIAN OCEAN ISLANDS

Mauritius: Pamplemousses (Royal Alfred Observatory) 20°06'S 57°33'E 55 m

| Period<br>1941–70<br>Bibliography<br>111, 113,<br>114, 115 | Temperature            |      |                    |       |          |      | Relative<br>humidity             |      | Precipitation              |                            |   | Bright sunshine                |                                       |                                      |  |
|--|------------------------|------|--------------------|-------|----------|------|----------------------------------|------|----------------------------|----------------------------|---|--------------------------------|---------------------------------------|--------------------------------------|--|
|  | Average<br>daily       |      | Average<br>monthly |       | Absolute |      | Average of<br>observations<br>at |      | Average<br>monthly<br>fall | Maximum<br>fall in<br>24 h | Average<br>No. of<br>days with<br>0.1 mm<br>or more | Average<br>monthly<br>duration | Average<br>per cent<br>of<br>possible | Maximum<br>duration<br>in<br>one day | Average<br>No. of<br>days with<br>no sun |
|  | Max.                   | Min. | Max.               | Min.  | Max.     | Min. | 1000                             | 1600 |                            |                            |   |                                |                                       |                                      |  |
|  | <i>degrees Celsius</i> |      |                    |       |          |      | <i>per cent</i>                  |      | <i>millimetres</i>         |                            |   | <i>hours</i>                   |                                       |                                      |  |
| January  | 30.3                   | 22.7 | 33.4               | 19.8  | 34.9     | 17.6 | 72                               | 70   | 176                        | 61                         | 21  | 261                            | 65                                    | —                                    | —  |
| February   | 30.2                   | 22.6 | 32.5               | 19.6  | 34.8     | 17.1 | 74                               | 72   | 203                        | 215                        | 20  | 229                            | 64                                    | —                                    | —  |
| March  | 29.7                   | 22.6 | 32.1               | 19.8  | 33.5     | 17.9 | 78                               | 75   | 245                        | 223                        | 23  | 216                            | 58                                    | —                                    | —  |
| April  | 28.6                   | 21.1 | 30.5               | 18.3  | 32.2     | 18.3 | 73                               | 70   | 163                        | 95                         | 20  | 232                            | 66                                    | —                                    | —  |
| May  | 27.0                   | 19.1 | 28.7               | 15.5  | 29.8     | 12.4 | 75                               | 73   | 63                         | 83                         | 19  | 234                            | 67                                    | —                                    | —  |
| June   | 25.3                   | 17.4 | 26.6               | 13.5  | 28.0     | 10.8 | 73                               | 72   | 65                         | 73                         | 18  | 221                            | 68                                    | —                                    | —  |
| July   | 24.5                   | 16.7 | 25.9               | 12.6  | 27.6     | 10.1 | 73                               | 70   | 63                         | 36                         | 19  | 226                            | 67                                    | —                                    | —  |
| August   | 24.7                   | 16.6 | 26.3               | 13.1  | 27.5     | 10.5 | 69                               | 66   | 58                         | 26                         | 20  | 231                            | 66                                    | —                                    | —  |
| September  | 25.8                   | 17.2 | 27.2               | 13.9  | 28.4     | 11.5 | 67                               | 65   | 38                         | 30                         | 17  | 236                            | 67                                    | —                                    | —  |
| October  | 27.4                   | 18.2 | 29.7               | 14.1  | 31.0     | 12.0 | 63                               | 62   | 34                         | 58                         | 13  | 266                            | 69                                    | —                                    | —  |
| November   | 29.3                   | 19.7 | 31.7               | 16.5  | 32.9     | 12.9 | 64                               | 65   | 79                         | 256                        | 13  | 267                            | 69                                    | —                                    | —  |
| December   | 30.3                   | 21.4 | 32.5               | 18.7  | 34.4     | 16.5 | 66                               | 66   | 128                        | 174                        | 18  | 270                            | 66                                    | —                                    | —  |
| Year   | 27.8                   | 19.6 | 33.7*              | 12.1* | 34.9     | 10.1 | 71                               | 69   | 1335                       | 256                        | 221   | 2889                           | 66                                    | —                                    | —  |
| No. of Years   | 26                     | 26   | 15                 | 15    | 15       | 15   | 9                                | 8    | 15                         | 9                          | 14  | 14                             | 13                                    | —                                    | —  |

Mauritius: Vacoas 20°18'S 57°30'E 423 m

| Period<br>1961–70<br>Bibliography<br>111 | Temperature            |      |                    |       |          |      | Relative<br>humidity             |      | Precipitation              |                            |   | Bright sunshine                |                                       |                                      |  |
|--|------------------------|------|--------------------|-------|----------|------|----------------------------------|------|----------------------------|----------------------------|---|--------------------------------|---------------------------------------|--------------------------------------|--|
|  | Average<br>daily       |      | Average<br>monthly |       | Absolute |      | Average of<br>observations<br>at |      | Average<br>monthly<br>fall | Maximum<br>fall in<br>24 h | Average<br>No. of<br>days with<br>0.1 mm<br>or more | Average<br>monthly<br>duration | Average<br>per cent<br>of<br>possible | Maximum<br>duration<br>in<br>one day | Average<br>No. of<br>days with<br>no sun |
|  | Max.                   | Min. | Max.               | Min.  | Max.     | Min. | 1000                             | 1600 |                            |                            |   |                                |                                       |                                      |  |
|  | <i>degrees Celsius</i> |      |                    |       |          |      | <i>per cent</i>                  |      | <i>millimetres</i>         |                            |   | <i>hours</i>                   |                                       |                                      |  |
| January                                  | 27.3                   | 20.4 | 29.3               | 17.5  | 31.6     | 14.6 | 78                               | 77   | 351                        | 495                        | 23  | 227                            | —                                     | —                                    | —  |
| February                                 | 27.5                   | 20.7 | 29.3               | 18.2  | 31.0     | 11.6 | 79                               | 78   | 317                        | 340                        | 21  | 205                            | —                                     | —                                    | —  |
| March                                    | 27.1                   | 20.7 | 29.3               | 17.8  | 30.8     | 14.3 | 81                               | 81   | 335                        | 284                        | 25  | 202                            | —                                     | —                                    | —  |
| April                                    | 26.0                   | 19.2 | 28.5               | 16.1  | 30.0     | 12.5 | 79                               | 78   | 168                        | 140                        | 21  | 218                            | —                                     | —                                    | —  |
| May                                      | 24.1                   | 17.5 | 26.9               | 13.8  | 28.8     | 11.8 | 78                               | 78   | 131                        | 103                        | 22  | 229                            | —                                     | —                                    | —  |
| June                                     | 22.3                   | 15.9 | 24.9               | 12.4  | 26.9     | 8.2  | 79                               | 79   | 133                        | 71                         | 22  | 205                            | —                                     | —                                    | —  |
| July                                     | 21.4                   | 15.2 | 23.9               | 12.4  | 25.7     | 8.7  | 79                               | 78   | 138                        | 66                         | 24  | 214                            | —                                     | —                                    | —  |
| August                                   | 21.5                   | 15.1 | 23.9               | 12.2  | 27.8     | 8.9  | 78                               | 76   | 126                        | 38                         | 25  | 221                            | —                                     | —                                    | —  |
| September                                | 22.2                   | 15.3 | 24.7               | 12.3  | 27.3     | 10.3 | 75                               | 74   | 93                         | 139                        | 21  | 217                            | —                                     | —                                    | —  |
| October                                  | 23.6                   | 16.0 | 25.9               | 13.1  | 28.0     | 11.4 | 72                               | 73   | 74                         | 68                         | 18  | 236                            | —                                     | —                                    | —  |
| November                                 | 25.5                   | 17.6 | 27.7               | 14.7  | 29.9     | 9.4  | 71                               | 74   | 11                         | 135                        | 17  | 219                            | —                                     | —                                    | —  |
| December                                 | 26.9                   | 19.2 | 30.0               | 16.4  | 30.6     | 14.1 | 74                               | 76   | 253                        | 331                        | 20  | 220                            | —                                     | —                                    | —  |
| Year                                     | 24.6                   | 17.7 | 29.9*              | 10.8* | 31.6     | 8.2  | 77                               | 77   | 2130                       | 495                        | 259   | 2613                           | —                                     | —                                    | —  |
| No. of Years                             | 20                     | 20   | 20                 | 20    | 20       | 20   | 20                               | 20   | 20                         | 20                         | 20  | 20                             | —                                     | —                                    | —  |

Reunion Island: St. Denis 20°54'S 55°31'E 10 m

| Period<br>1952–70<br>Bibliography<br>112, 116,<br>117 | Temperature            |      |                    |       |          |      | Relative<br>humidity             |      | Precipitation              |                            |   | Bright sunshine                |                                       |                                      |  |
|---|------------------------|------|--------------------|-------|----------|------|----------------------------------|------|----------------------------|----------------------------|---|--------------------------------|---------------------------------------|--------------------------------------|--|
|   | Average<br>daily       |      | Average<br>monthly |       | Absolute |      | Average of<br>observations<br>at |      | Average<br>monthly<br>fall | Maximum<br>fall in<br>24 h | Average<br>No. of<br>days with<br>0.1 mm<br>or more | Average<br>monthly<br>duration | Average<br>per cent<br>of<br>possible | Maximum<br>duration<br>in<br>one day | Average<br>No. of<br>days with<br>no sun |
|   | Max.                   | Min. | Max.               | Min.  | Max.     | Min. | 0930                             | 1530 |                            |                            |   |                                |                                       |                                      |  |
|   | <i>degrees Celsius</i> |      |                    |       |          |      | <i>per cent</i>                  |      | <i>millimetres</i>         |                            |   | <i>hours</i>                   |                                       |                                      |  |
| January   | 29.5                   | 22.8 | 31.6               | 20.1  | 33.8     | 18.2 | 78                               | 72   | 263                        | 197                        | 19  | 240                            | —                                     | —                                    | 1  |
| February  | 29.9                   | 23.0 | 31.7               | 20.5  | 33.7     | 18.6 | 79                               | 70   | 216                        | 268                        | 17  | 215                            | —                                     | —                                    | 1  |
| March   | 29.4                   | 22.8 | 31.0               | 20.5  | 31.8     | 18.6 | 82                               | 75   | 290                        | 354                        | 18  | 209                            | —                                     | —                                    | 3  |
| April   | 28.3                   | 21.3 | 29.9               | 18.3  | 31.2     | 15.6 | 79                               | 69   | 160                        | 200                        | 13  | 222                            | —                                     | —                                    | 1  |
| May   | 26.9                   | 19.6 | 28.7               | 16.6  | 30.5     | 15.4 | 76                               | 67   | 81                         | 103                        | 14  | 236                            | —                                     | —                                    | < 1                                      |
| June  | 25.5                   | 18.2 | 27.1               | 15.5  | 28.3     | 13.6 | 74                               | 64   | 75                         | 62                         | 14  | 220                            | —                                     | —                                    | < 1                                      |
| July  | 24.7                   | 17.4 | 26.3               | 14.2  | 27.3     | 12.9 | 74                               | 66   | 70                         | 70                         | 17  | 224                            | —                                     | —                                    | 1  |
| August  | 24.5                   | 17.2 | 26.0               | 13.9  | 27.3     | 12.8 | 74                               | 64   | 49                         | 36                         | 16  | 219                            | —                                     | —                                    | 0  |
| September   | 25.3                   | 17.2 | 27.1               | 14.6  | 28.7     | 13.0 | 74                               | 65   | 47                         | 92                         | 14  | 217                            | —                                     | —                                    | 0  |
| October   | 26.0                   | 18.7 | 27.9               | 15.7  | 28.5     | 14.7 | 71                               | 64   | 44                         | 76                         | 12  | 221                            | —                                     | —                                    | < 1                                      |
| November  | 27.3                   | 20.2 | 29.2               | 17.3  | 31.3     | 15.0 | 69                               | 67   | 95                         | 212                        | 13  | 212                            | —                                     | —                                    | 1  |
| December  | 28.6                   | 21.9 | 30.5               | 19.2  | 31.6     | 17.8 | 75                               | 72   | 151                        | 146                        | 16  | 217                            | —                                     | —                                    | 1  |
| Year  | 27.2                   | 20.0 | 32.1*              | 13.6* | 33.8     | 12.8 | 75                               | 68   | 1541                       | 354                        | 183   | 2652                           | —                                     | —                                    | 9  |
| No. of Years  | 18                     | 18   | 17                 | 17    | 20       | 18   | 7                                | 7    | 18                         | 18                         | 18  | 18                             | —                                     | —                                    | 6  |

\*Average of highest/lowest each year

