A study of plants in the Bromeliaceae family, and their specific environmental adaptions in the context of both their natural habitat, and in botanical cultivation environments.

Lily O'Neill, September 2018

Image of the author stood behind the leaf of *Colocasia gigantea*, in the tropical nursery at Inhotim.

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Image of *Vriesea neoglutinosa*, seen at Itacoatiara.

Aims and Objectives

- To expand and improve plant knowledge;
- To study native flora;
- To experience a different climate and observe how plants normally grown under glass in the UK will grow in their natural habitat;
- To learn more about the specific adaptions plants in the Bromeliaceae family have undergone in order to make the most of their environment, and to gain a better understanding of plant adaption techniques;
- Experience *in-situ* and *ex-situ* plant habitats;
- Experience working in a different botanic garden;
- To work alongside experts in the field and learn professional practices relating to horticulture in Brazil;
- To look at different botanic collections in Brazil in order to gain a more wide-ranging knowledge of Bromeliaceae;
- To gain experience of plant collection in the wild;
- To observe and record the plant adaptions of the Bromeliaceae family;
- Broaden career horizons and forge ties with other botanical organisations;
- To share knowledge with Kew.

Itinerary

Day 1 – 01.09.18 – Flew to Rio de Janeiro and stayed one night in a hostel.

Day 2 – 02.09.18 – Flew to Belo Horizonte, where I was met by Juliano Borin, my contact at Inhotim. He drove me to Brumadinho where I was based for the next 7 days. In this time, I spent every day at Inhotim, touring the expanse of the gardens and assisting in a planting project.

Day 8 - 08.09.18 - Flew back to Rio de Janeiro.

Day 9 – 09.09.18 - Met with Bruno de Silva, the curator of the Bromeliaceae collection at Jardim Botânico. We went on a hike in the Tijuca Forest National Park.

Day 10 – 10.09.18 - Met Bruno at Jardim Botânico, where I spent the next 5 days getting to know the different collections in the gardens, particularly the Bromeliaceae collection, and the more general practices of this botanic garden.

Day 15 – 15.09.18 - Visited Niteroi with Bruno and hiked up one of the inselbergs in Itacoatiara, observing Bromeliads in the wild.

Day 17 – 17.09.18 - Returned to Rio, where I spent the final week of my trip visiting sites of personal interest.

Day 23 – 23.09.18 - Flew home to the UK.

Locations

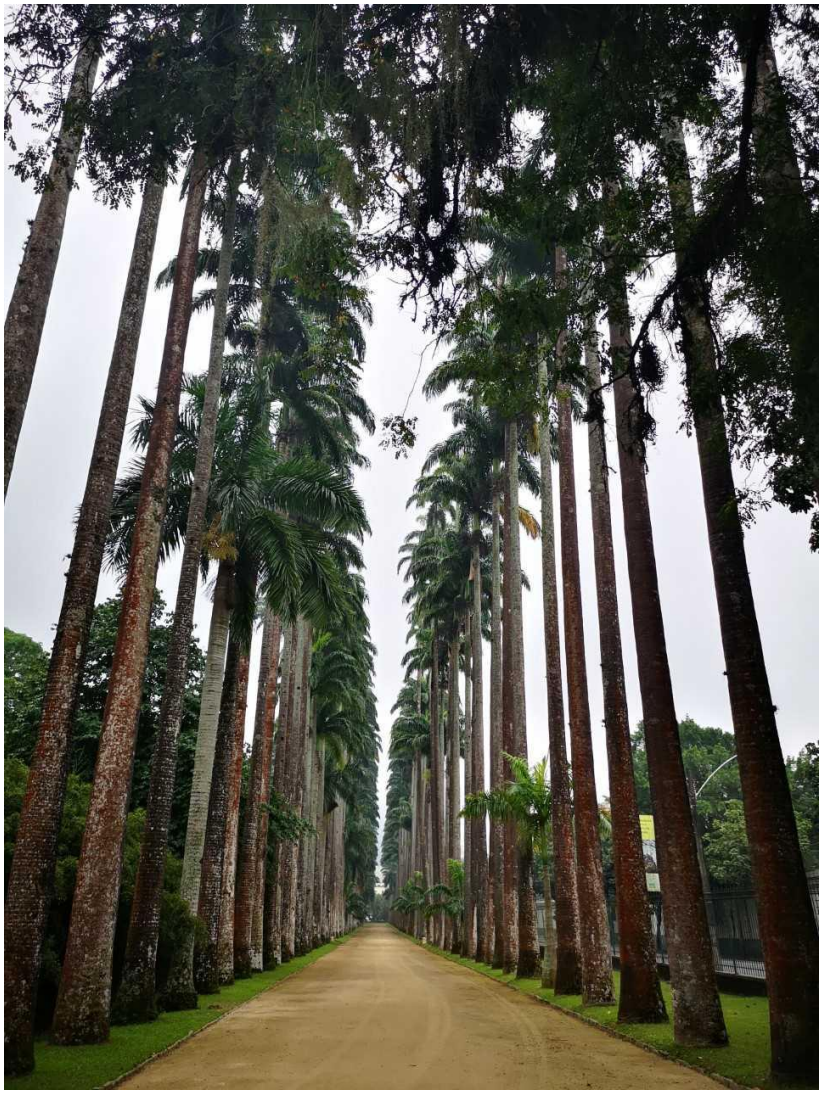
Inhotim

The thousands of sprawling acres of tropical landscape that make up Inhotim left me quite speechless. This location combines art and nature, housing roughly 20 galleries set amidst a luscious backdrop that is best described as if Capability Brown and William Kent had created their landscape gardens in a tropical paradise. Known primarily for its function as an outdoor art centre, the botanical aspect of Inhotim was one that grew to intrigue me. It was only certified as an official botanical garden in 2013, making this possibly one of the youngest botanical gardens. This is something that holds great interest for me; the two functions of Inhotim, art and nature, began to appear as more of a wrestling match than a collaboration. It seems that there is a struggle between the art world of Inhotim, and its nascent botanical directive. I was informed that the 'art world' of Inhotim regards the landscape that surrounds the galleries as something of a mere picture frame, operating solely as a backdrop to highlight the art which takes precedence. This palpably posed a hindrance to the botanical aims of the horticultural team, something which I got to experience first-hand during my stay.

One of the many delightful views at Inhotim. Pictured here is a swathe of *Cordyline* in the forefront, and across the river are some *Bizmarckia nobilis*, the blue of which contrasts beautifully with the bright block colours of the gallery slightly visible behind.

Jardim Botânico

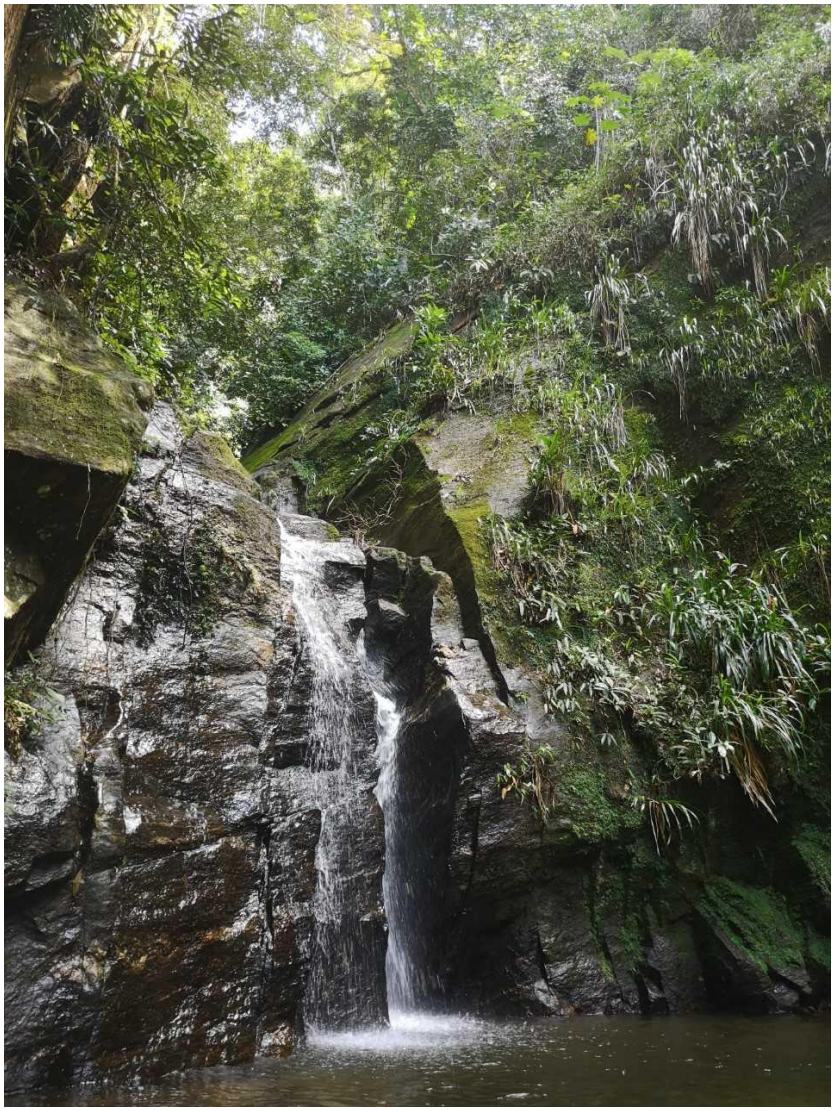
Nestled at the base of the Corcovado Mountain, and seemingly surrounded on all sides by lush tropical hills, Rio de Janeiro's botanical garden has its own distinct character. Founded at the turn of the 19th Century by the contemporary King of Portugal, this botanic garden felt much more similar to Kew, in the sense of its history and being a well-established science and research institution. The location of the garden and its proximity to the sea means that moisture from the sea climbs over the mountains and condenses over the garden, leaving Jardim Botânico frequently shrouded in cloud and mist. This climate, on top of creating a dramatic and atmospheric feel to the garden, ensures that the plants of Jardim Botânico are kept moisture and nutrient rich, and result in some striking vistas. The Royal Palm avenue in particular benefits from this microclimate. Known as the Cuban Royal Palm, *Roystonea regia* is native to the region spanning the Caribbean islands, where storm activity would keep the height of these palms somewhat stunted. In the sheltered environs of Jardim Botânico, these palms tower above all else and it is a special experience to walk under them.



Pictured above is the aforementioned Royal Palm Avenue, in all its towering glory.

Tijuca Forest National Park

Officially declared a national park in 1961, the Tijuca Forest is believed to be one of the largest urban forests, making it an important facet of flora in Brazil. What is also very interesting is the history of the park – during colonial times, the hills upon which the forest sits were cleared of all vegetation to make way for sugar and coffee plantations. This decision was fairly quickly assumed to be a grave mistake. It was noted that the removal of the rainforest was adversely affecting the levels of rainfall, jeopardizing water supplies for the inhabitants of the city. What was also noted was the effect that the plantations were having on soil erosion, and the consequences this would have. The decision was made to replant the hills with rainforest, and since the latter half of the 19th Century this is how they have remained. The perils of the practice of deforestation were recognized in Rio de Janeiro well over a century ago, which I think is worth noting in this current age where we are still battling to stop this ecologically damaging activity.



One of the waterfalls in Tijuca, to the right of which are some lithophytic *Pitcairnia*.

Costão de Itacoatiara

An inselberg that marks the end of Itacoatiara beach, this location was as unique as all the other places that I visited. The hike starts in a forest, but quickly opens up to the bare rock face, up which you climb to gain stunning views of the surrounding area. The botanical interest of this site is that it is an ideal location for seeing lithophytic plants in the Bromeliaceae family, and indeed some lithophytic cacti which was an added delight. Getting to see and experience the extreme conditions that these plants have made their home was especially interesting to me, proving to be a stark reminder of the level of adaption the Bromeliaceae family has undergone.

This is the view of Pedra do Elephante, another inselberg, from the Costão inselberg that we climbed.

Work programme

Inhotim

I spent the first day at Inhotim in a buggy, touring the vast area that makes up the gardens. I got to know the history of the place, and had several interesting native trees pointed out to me, such as *Handroanthus*, known locally as 'Ipe', and my personal favourite *Cecropia*, notable due to its myrmecophytic relationship with ants.

I was also taken behind the scenes, to the storage houses for the plants. These ranged in construction material – most were simply a large pole structure covered with netting, as of course these plants are in their natural habitat, and don't need the glass confines I am so used to, in order to survive. If anything, the opposite applied here in Brazil – the germination house had a very impressive ventilation system which consisted of a large wall full of rocks/ceramic, through which water poured constantly. At the other end was a huge fan which dragged the cool air through the house, in order to keep the seedlings well ventilated. It is a simple system, but it struck me as a rather elegant solution to the scorching heat of the Brazilian Summer (I very deliberately visited in the Winter).

For the next few days I was chiefly occupied with aiding in preparations for several new exhibition openings taking place on the Thursday. This entailed planting up the areas outside the galleries, and Juliano and I took charge of planting up a huge mango tree with various epiphytes. We had many plants from the Bromeliaceae family and from the Araceae family, and *Ripsalis*, which held particular interest to me as I did not know that there were epiphytic cacti.

Before and after shots of the mango tree – as you can see, we attempted to keep it looking very naturalistic, but tried to tactically mask the areas where limbs had been removed.

Jardim Botânico

After the tropical paradise of Inhotim, my impression of Jardim Botânico struck a harsh contrast. It felt like a brooding place; the low-hanging mist and deep green of the tree canopies felt much more like the jungle I expected to find when I thought of the Atlantic rainforest. Jardim Botânico was also much closer to my expectations of what a botanical garden across the world would be – different to Kew in many respects, but with a core principle and directive that I would relate to. Inhotim is a seedling in the life of a botanic garden, whereas Jardim Botânico is far more mature, due simply to its head-start of two centuries of existence in Brazil.

An image of the Friar Leandro Mound, built from excavated soil left over from the construction of the lake. Friar Leondro was director of Jardim Botânico in the early 19th Century, and is credited with starting the scientific organization of the Arboretum at the site. In the bottom right corner of the photo you can see a signpost offering interpretation for this monument – signs like these were dotted around the gardens and provided text in Portuguese and English.

My first day at the garden was spent exploring the area, in particular the Bromeliario, the Bromeliad house, and the behind-the-scenes storage house for the Bromeliads which, like at Inhotim, was covered in a black netting. The condition of this storage house highlighted the primary challenge for Jardim Botânico as a botanical institution, and this is financial. The wooden benches were rotting and several were on the verge of collapse, and this has been the case for several years, but unfortunately the Brazilian government does not list such things as a high priority. Jardim Botânico suffers from a lack of funding, but despite that I would say it still functions as a worthy and

wholly necessary site of research and houses a valuable scientific collection, both living and dried in the Herbarium.

During my time at the garden, I got to visit the Herbarium, and took part in pressing and drying some Bromeliad specimens for their collection. This was very interesting for me, as a botanical horticulturalist, to witness firsthand the process which has provided us with plant material dating hundreds of years back. Jardim Botânico is currently in the process of digitizing their collection, and I believe actions like this will be immensely enriching for our global plant knowledge in the future.

Either side of my time in Jardim Botânico, I went on the day hikes to Tijuca National Park and Itacoatiara. These were a nice chance to observe the flora of the area in a more natural setting, and it was very exciting to observe Bromeliads in the wild, particularly at Itacoatiara. As previously mentioned, the sheer rock face provided a harsh environment for these plants. To see them thriving despite this, perfectly illustrated nature's striking ability to adapt to even the most unforgiving habitats.

An image of me at Itacoatiara, pointing out some *Neoregalia cruenta*, alongside some *Coleocephalocereus*. There is little soil here to provide nutrients so the plants root to the rock face purely for anchorage, getting their nutrients from the rich sea air.

To conclude, while I did indeed witness the wide range of Bromeliad adaptions that I had set out on this trip to experience, I feel that my trip was worthwhile for other reasons. My time at the botanic gardens opened my eyes to the importance of such institutions, on a global scale but also on a much more local standing. Brazil is one of the most ecologically important countries on our planet, and I think the botanical institutions of Brazil can hopefully help bring plant conservation to the forefront of the mind of the country.

In regards to future trips, I am intrigued to see how Inhotim develops as a botanic garden over the next few decades, and hope to go back and track its progress. The transformation of a landscape garden into a botanical institution is one that holds great interest to me, and I would encourage anyone passionate about botanic gardens to visit Inhotim and see the early stages of this establishment.

Acknowledgements

I would like to thank the Royal Horticultural Society, for providing me with such a generous bursary, without which I would not have been able to make this trip.

I would also like to thank the Merlin Trust for a similarly generous bursary, which helped me make this trip a reality.

I would like to thank Marcelo Sellaro, Botanical Horticulturalist in the Tropical Nursery, RBG Kew. Marcelo set me up with invaluable contacts, provided me with background reading material, and supported me throughout this trip.

I would like to thank Juliano Borin, Agronomist Engineer at Inhotim. Juliano was a gracious host, imparted his wealth of plant knowledge to me, and went above and beyond to make my experience at Inhotim valuable and unforgettable.

I would like to thank Bruno Rezende Silva, Curator of the Bromeliaceae collection at Jardim Botânico. Without Bruno I would not have been able to experience such vastly different habitats in such a small locale. His lifetime of knowledge of the area around Rio de Janeiro, and of plants in the Bromeliaceae family, afforded me a window into the world of the flora of Brazil.

Finally, I would like to thank Greg Redwood, Lara Jewitt, and Martin Staniforth, for authorizing my trip and allowing me to embark upon this adventure.

Cost breakdown for Brazil

Item	Brazilian Reals	GBP
Flights to and from Rio	n/a	750.00
Kaza Rio hostel	35.00	6.64
Hostel 70	725.00	137.48
Che Lagarto Hostel	423.22 (USD)	329.48
Money for food and drink	1000.00	221.14
Personal spending money	500.00	104.90

Total spent: £1,549.48

Amount received from RHS: £1,000.00

Amount received from The Merlin Trust: £360.00

I feel it should be noted that I incorrectly budgeted in my initial planning stages, resulting in me going slightly over budget. This is because I had estimated my costs on staying in a dorm room in each hostel, but I later realised it would be much more beneficial to have private rooms in each place, resulting in my accommodation costing more than I had anticipated. Thankfully, my flight ended up slightly cheaper than expected, so I feel that the costs balanced out. As you can see, the money went almost entirely on travel and accommodation costs, as I was afforded free entry to both Inhotim and Jardim Botânico, and the national parks I visited were both free to enter.

I declare that all information regarding my cost breakdown is accurate.

Lily O'Neill, Author.

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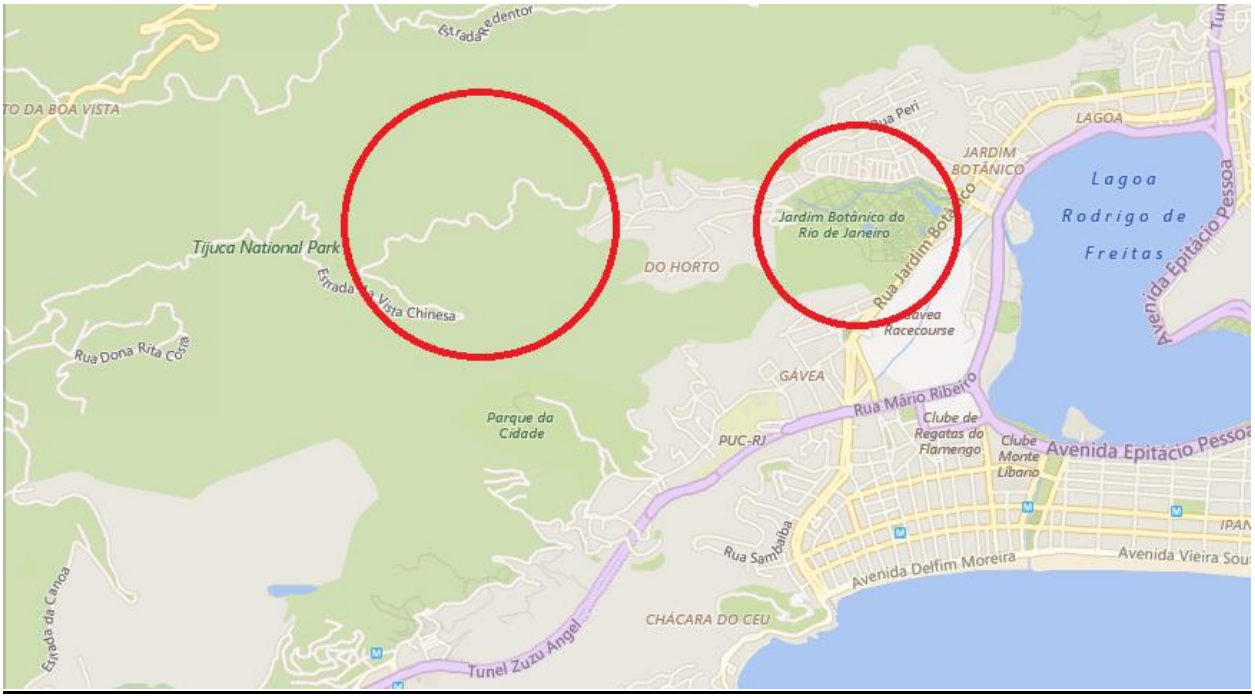
Appendices

Maps



Map of Rio de Janeiro, showing the location of Jardim Botânico (right) and of the area in Tijuca Forest National Park where we hiked (left).

Map showing the location of Itacoatiara, and its proximity to Rio de Janeiro.

Map showing the location of Inhotim in Minas Gerais, and its proximity to Rio de Janeiro.