

# The Ferns of Antigua and Barbuda: A Case of Resurgence and Resilience

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My passion for wild ferns goes back to my early childhood on a farm on the island of Antigua. I spent many days in the wild open pastures and woodlands day-dreaming about such primitive places while I explored the *Nephrolepis* fern groves, hoping that the land before me would suddenly be transformed into a hot humid and wild jungle like those I often read about in books or saw on television.

In later years, as a forester with the Ministry of Agriculture (this was in the early 1990s), I discovered that the islands had relatively few fern species when compared to the wetter and more volcanic neighbouring islands such as St. Kitts; this disappointed me. It seemed that my dream of Antigua blossoming into a verdant primeval jungle with giant tree ferns was even more fanciful than I had imagined as a child.

Out of this disappointment grew a greater urgency to know about my islands' ferns because I was convinced that there were many more species than had been previously reported. In 2008, I began a study of the ferns of the islands of Antigua, Barbuda, and Redonda in attempt to determine the number of species, their distributions and habitats as well as their conservation status. During my research, I have learned that the fern species here are remarkably resilient, despite several centuries of deforestation and continued loss of habitats in some areas of all three islands, as well as the increasing impacts of global climate change. In fact, Antigua is seeing an increase in the number of fern species, and this upsurge in numbers is likely due to an increase in moist forest cover in some parts of the hills of the volcanic south of the that island.

Before we look at the ferns, let me give you a brief overview of the tropical island setting.

The country of Antigua and Barbuda is a tripartite state, consisting of three islands, namely: Antigua (280 km<sup>2</sup>), Barbuda (161 km<sup>2</sup>) and Redonda (2.6 km<sup>2</sup>). It is located 402 km southeast of the United States territory of Puerto Rico. The state is part of the Lesser Antillean grouping commonly referred to as the Leeward Islands. The capital of the country is St. John's, located on the shore of a deep harbour on the northwestern coast of Antigua. The island has a total population of over 81,000 (2011 Census), with an average population density of about 360 people/km<sup>2</sup>. Barbuda has just one settlement, Codrington, and a population of about 1,400 people. Until November 1981, these islands were a part of the colonial West Indian territories of Great Britain.

When A. Alston and Harold Box wrote the *Pteridophyta of Antigua* in 1935—for decades the only compendium of the island's ferns—the landscape was dominated by large tracts of sugar cane fields. Even 26 years later, much of the island was intensively cultivated, as shown in the image in Fig.1 taken in 1961 (Antigua looking toward the northeast). Alston was a British botanist and naturalist of considerable talent, and was quite familiar with the flora and landscapes of many of the West Indian islands. Box was at the time, the Government Entomologist at the Antigua Sugar Factory.



Fig. 1. Aerial view of northeast Antigua showing mosaic of extensive cane fields. Photo taken by botanist Walter H. Hodge, circa 1960s. Source Island Resources Foundation Walter H. Hodge collection.

Along with his official role, he also spent a great deal of his time exploring the island, recording many of its natural features, including its plants.

During the periods of sugarcane cultivation, there remained small forest fragments, especially on some hills and in steep valleys, and ribbons of woodland along streams and property boundaries. Though these plant communities were only fragmentary, they perhaps served as seed-banks, harbouring spores, which may have allowed the repopulation of species in later years.

In Alston and Box's overview of the ferns of Antigua, they listed about 35 species (the authors also suggested the presence of the hybrid *Thelypteris x rolandii*, a naturally occurring cross between *T. tetragona* and *T. poiteana*), most of which were limited to the more humid woodlands of the southern volcanic region of the island, where the highest point is Mount Obama (Boggy Peak during his time) at 403 meters.



Fig.2. The island of Redonda from the air. Photo courtesy, Brian Cooper 2012.

# The Ferns of Antigua and Barbuda: A Case of Resurgence and Resilience

Box also made observations on the ferns and other plants of the sister island of Redonda and published *A Note on the Vegetation of Redonda, B.W.I* in 1939, providing a useful timeline and overview of the rapidly changing natural environment of the small uninhabited island. Redonda was once extensively mined for guano from the late 1800s to around 1921. This changed the landscape very dramatically. Today, Redonda is unfortunately overrun by feral goats and introduced rats, which have wreaked havoc on the native plants and animals of the island. Fig. 2 shows an aerial view of this island.

No similar work was published for the ferns and other plants of Barbuda, though Box and other experts spent time there.

To establish the extensive agricultural fields of Antigua, the British began clearing the land of its native old growth forest soon after the first settlement was established in 1632. In less than 100 years, the island had been transformed into thousands of hectares of sugar cane fields, small-scale agricultural holdings and vegetable crop farms, especially in the central and northern regions, with more tree, fruit and crop farms (cultivating yams, taro, sweet potato, bananas, cassava, among other things) established in the volcanic hills of the south. Deforestation continued well into the 1800s, especially to obtain wood to fuel the factories that manufactured sugar. Fig. 3 shows a crew felling large Silk Cotton (*Kapok*) trees (*Ceiba pentandra*) at Wallings in the south of the island sometime in late 1800s. Note the numerous epiphytes covering the trunk.

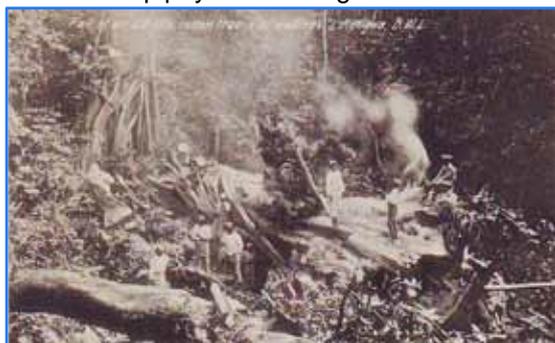


Fig. 3. Fall of an old silk cotton, circa late 1800s by John Anjo. Source: Museum of Antigua and Barbuda.

The felling of the islands' forests likely resulted in the disappearance and even the extinction of many species of native plants and animals. Ferns, especially epiphytic species, declined, and by the end of the 18<sup>th</sup> Century, only a few species persisted, and only those that were hardy enough to survive in the desiccated, fragmented and degraded patches of remaining woodlands. Alston's and Box's 1935 summary review offers a rare window onto the environmental conditions to the island at that time, and it suggests that the flora consisted of species that were fairly

widespread throughout the Caribbean, most being generalist that were able to survive in a range of environments, including dry seasonal to evergreen moist forests, and from sea level to the highest point. Even so, some species were quite rare, limited to the steep valleys of the volcanic south. The species that Alston and Box recorded are shown in table 1 below, and list 35 species.

Species	Status in 1935 Alston & Box	Status in 2013 (Lindsay)
<i>Acrostichum aureum</i> Linnaeus	Rare	Rare
<i>Acrostichum danaeifolium</i> Langsd. & Fisch.	Common	Uncommon
<i>Adiantopsis radiata</i> (L.) Fée	Rare	Rare
<i>Adiantum tenerum</i> Sw.	Common	Common
<i>Adiantum tetraphyllum</i> Humb. & Bonpl. ex Willd.	Rare	Uncommon
<i>Adiantum villosum</i> Linnaeus	Common	Common
<i>Anemia adiantifolia</i> (L.) Sw.	Uncommon	Common
<i>Anemia hirta</i> (L.) Sw.	Rare	Uncommon
<i>Asplenium cristatum</i> Lam.	Common	Common
<i>Asplenium pumilum</i> Sw.	Rare	Common
<i>Asplenium serratum</i> Linnaeus	Rare	Uncommon
<i>Blechnum occidentale</i> Linnaeus	Uncommon	Common
<i>Campyloneurum phyllitidis</i> (L.) C. Presl	Common	Common
<i>Cheilanthes microphylla</i> (Sw.) Sw.	Rare	Uncommon
<i>Didymoglossum krausii</i> (Hook. & Grev.) C. Presl	Common	Common
<i>Doryopteris pedata</i> (L.) Fée	Rare	Uncommon
<i>Microgramma heterophylla</i> (L.) Wherry	Common	Common
<i>Microgramma lycopodioides</i> (L.) Copeland	Common	Common
<i>Nephrolepis biserrata</i> (Sw.) Schott.	Uncommon	Common
<i>Neurodium lanceolatum</i> (L.) Fée	Rare	Common
<i>Phlebodium aureum</i> (L.) J. Smith	Common	Common
<i>Pityrogramma calomelanos</i> (L.) Link	Common	Common
<i>Pleopeltis polypodioides</i> (L.) E.G. Andrews & Windham	Common	Common
<i>Psilotum nudum</i> (L.) P. Beauv.	Rare	Rare
<i>Pteridium caudatum</i> (L.) Maxon	Rare	Extinct?
<i>Pteris biaurita</i> Linnaeus	Rare	Uncommon
<i>Pteris vittata</i> Linnaeus	Common	Common
<i>Serpocaulon triseriale</i> (Sw.) A.R. Sm.	Uncommon	Common
<i>Tectaria heracleifolia</i> (Willdenow) L. Underw.	Rare	Uncommon
<i>Tectaria incisa</i> Cav.	Common	Uncommon
<i>Thelypteris dentata</i> (Forssk.) E.P. St. John	Common	Common
<i>Thelypteris patens</i> (Sw.) Small ex R.P. St. John	Common	Rare
<i>Thelypteris poiteana</i> (Bory) Proctor	Rare	Rare
<i>Thelypteris tetragona</i> (Sw.) Small	Common	Common
<i>Vittaria lineata</i> (L.) Sm.	Rare	Uncommon

Table 1. Summary status of fern species listed by Alston and Box in 1935 and their status today.

Note that Alston's & Box's species names have been updated where necessary.

The situation for most of the ferns has improved considerably since 1935, in that many are found more widely, and/or population numbers have increased, while a handful have remained rare (this may be a natural dynamic).

It is not known how Alston and Box arrived at the status for each species, but given the landscape at the time, and the relative paucity of forests and woodlands, it is not hard to imagine how conclusions

## The Ferns of Antigua and Barbuda: A Case of Resurgence and Resilience

were reached. The authors often suggested that a species was “very scarce” or “only found once” and so on, and may also say the species is “common” or “rare.”

For my work, my experience often paralleled that of Alston and Box, and many of the species are only known from a handful of locations, one plant or one population, and so on. I used the IUCN species assessment approach to determine the conservation status of many species (though not all have been evaluated). For a full conservation assessment of the islands’ ferns please refer to the Regional Red List of pteridophytes of Antigua, Barbuda and Redonda (2012). For the purpose of this article, simpler terms have been employed to denote the status of the species.

By 1997, Island Resources Foundation (IRF), in a report on the country’s *Biodiversity Profile for Antigua, Barbuda, and Redonda* (Lindsay and Horwith), increased the number of species for the islands, and listed 45 ferns (43 for Antigua and two for Barbuda).

Between 2007 and 2009 when the Environmental Awareness Group (EAG) published *The Wild Plants of Antigua and Barbuda*, the number of fern species increased from 45 to about 54.

By 2013, my field work determined that country has at least 109 species, far more than the 35 that Alston and Box recorded. Some of the increase is due to taxonomic revisions and splits, the recognition of many hybrids, and because of several introduced species, but most were new records such as the first documentation of the primitive *Ophioglossum reticulatum* for Antigua. Though a widespread species across the Caribbean and in other parts of the world, it is a rare species here. In fact, not long after that discovery, we found a single colony of another species *Ophioglossum harrisii*, a rare West Indian endemic (Fig. 4). Both species prefer grassy moist slopes with partial shade to full sun. They are also easily overlooked or mistaken for other plants given their simple leaves and terrestrial habits.



Fig. 4. *Ophioglossum harrisii* in the southern hills of Antigua.

Another great find—adding to our growing fern list—is *Adiantum fragile*. Adiantums, with their lacy fronds are a favourite of local gardeners, and in fact, are cultivated the world over. There are two varieties of this species on Antigua, these being *A. fragile* var. *fragile* and *A. fragile*



Fig. 5. *Adiantum fragile* var. *rigidulum*, Antigua.



Fig. 6. *Didymoglossum ovale* found growing on boulder, Antigua.



Fig. 7. *Asplenium uniseriale* on rocky escarpment at Christian Valley, Antigua.



Fig. 8. *Marsilea nashii*, a West Indian endemic aquatic fern in Barbuda.

## The Ferns of Antigua and Barbuda: A Case of Resurgence and Resilience

var. *rigidulum* (Fig. 5). The latter is the smaller and more delicate of the two forms; it is also quite rare, known only from a handful of locations and a few plants.

Some species are very tiny and easily overlooked — they resemble mosses or hide amongst them (see Fig. 6). Alston and Box observed the diminutive filmy fern, *Didymoglossum krugii*, which is widespread in moist ravines and woodlands, often found growing on boulders, rocks and tree trunks. It is one of about nine species and varieties, found on Antigua since 2008. One of these is the country's smallest fern, *Didymoglossum ovale* (Fig. 6). So far, *D. ovale* is known only from one small colony found growing on a few rocks in a damp, dark, valley bottom in the southern hills.

Several species remain a taxonomic challenge, including *Pityrogramma*, and members of the *Asplenium cristatum*-complex. Many of the species closely resemble each other, and are very difficult to tell apart. This is compounded when two or more species grow in close proximity or in the same area. Fig. 7 shows what is believed to be *Asplenium uniseriale* found growing at Christian Valley in the southern hills. Its delicate and graceful fronds often have long attenuated tips.

In Barbuda, we have added another species of *Marsilea*, the clover-leaf aquatic ferns, which now means the island has two types: *Marsilea nashii* (Fig. 8) a West Indian endemic, and *Marsilea ancylopoda*, widespread throughout parts of the Neotropics. The island's list is now up to about 10, when previously, it was about two.

Redonda has at least six species, including the beautiful Island Goldback Fern (*Pityrogramma chrysophylla* var. *subflexuosa*), endemic to the Virgin Islands, Montserrat and Redonda (Fig. 9), with the bright yellow powder covering the underside of the leaves.



Fig. 9. *Pityrogramma chrysophylla* var. *subflexuosa* on Redonda. Photo courtesy Dr. Jenny Daltry, Fauna and Flora International, 2011

What accounts for the dramatic increase in numbers of ferns recorded? How did Alston, Box and others miss so many species? There are several reasons for this: many experts and observers only made occasional efforts to study the islands' species and could have overlooked several forms. Their field observations would have also missed many species because they are quite rare, limited in many instances to just one narrow valley or a handful of plants on a few boulders or trees.

During the 1930s to 1980s, many of the areas of Antigua consisted of open grasslands and scrubby patches of woods. With the abandonment of intensive export-driven agriculture since 1980, many were left fallow and have transitioned to taller and more stable forest habitats, which have provided the needed environments and conditions for ferns to prosper. In the early 1980s, areas such as Midway Ridge and the slopes of Mount Obama were a mosaic of extensive grass, shrublands and patches of forest, but by the early 2000s, many of these areas reverted to secondary woodland and the region is now largely wooded. Fig. 10 shows a view of the Christian Valley and the surrounding summits of Midway Ridge and of the highest point on Antigua, Mount Obama. The photo was taken from McNish Mountain.

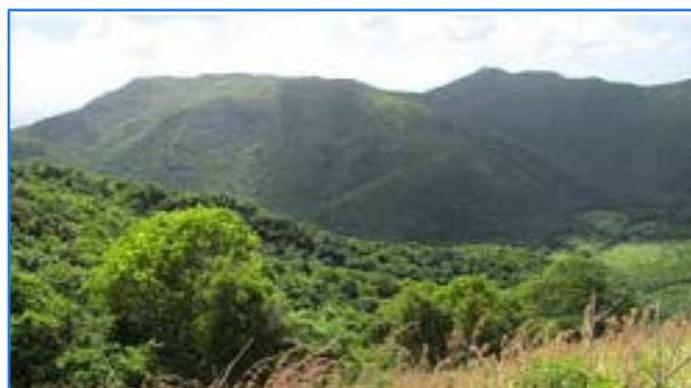


Fig. 10. View of Midway Ridge, summit to left in background and Mount Obama summit in right background with communication tower.

Mature old trees also create suitable sites for epiphytic species to become established. The tall trees also provide shade and help to increase levels of humidity in upland and valley areas, conditions loved by many ferns. These sites were once denuded and exposed to destructive ultraviolet radiation, desiccating winds, the ravages of goats and other livestock, and erosion. Previously small, fragmented woodland patches are now a network of forests, woodlands, scrub, patches of grassland, rocky cliffs and herbaceous growth, offering a complex and diverse system of habitats that allow increasing biodiversity in the area.

Nevertheless, severe challenges remain, especially because some fern species are known from only one small colony or just one plant. This makes them vulnerable to disturbances, including droughts, floods, land-clearing, diseases, invasive species, and fires. Added to this is the increasing stress of the effects of climate change and sea level rise, which compound and amplify existing threats.

While some areas in the volcanic south of Antigua are seeing an increase in forest habitats, the central, northern and northeastern end of the island are experiencing a decline in forest cover and a loss of wetlands due to tourism and upscale housing developments.

On Barbuda, introduced feral livestock, which include goats, sheep, pigs, donkeys, horses, Fallow Deer (*Dama dama*) and wild boar, some of which may have been introduced as early as the 1500s, are causing a gradual but steady ecological decline in ecosystems. Barbuda also has seen a dramatic increase in sand mining and quarrying, which have destroyed large tracts of rare native woodlands.

## The Ferns of Antigua and Barbuda: A Case of Resurgence and Resilience

Redonda is now largely deforested due to guano mining, to goats introduced prior the 1600s and introduced Black Rats (*Rattus rattus*).

Sadly, at least two species: *Pteridium caudatum* and *Microgramma piloselloides* may be locally extinct on Antigua. Field surveys have so far turned up no evidence that either species is still present on the island. Fig. 11 shows the author high on the slopes of Saddle Hill, from where Alston and Box reported *P. caudatum*.

Field studies continue, and new species are likely to turn up. But it is now necessary to develop effective ways to protect suitable habitats and ensure that these species maintain sustainable populations. Working with local authorities, I have been planning the development of a native plant nursery and garden to maintain populations of native species, and to eventually repatriate many of these to the wild. These plans are now in the beginning stages.

My field study of the ferns of Antigua, Barbuda and Redonda has been under the auspices of the Environmental Awareness Group (EAG) of Antigua and Barbuda, and generously funded by the Rufford Small Grants for Nature Conservation, UK, and the Mohamed bin Zayed Species Conservation Fund, Abu Dhabi. The study has resulted in the production of a Regional Red List of Ferns for Antigua and Barbuda, and a Conservation Perspective, both researched and authored by myself, and which can be freely downloaded from the EAG fern project website at: <http://www.eagantigua.org/page525.html>. Also being produced is a guide to the ferns, expected by early summer of 2014.



Fig. 11. The author, Kevel Lindsay, searching for *Pteridium caudatum* high on the slopes of Saddle Hill on Antigua in October of 2013.

### References:

- Alston, A.H.G. & H.E. Box. 1935.** *Pteridophyta of Antigua* Journal of Botany, Vol. 73 No., 366.
- Beard, J.S. 1949.** *The natural vegetation of the Windward and Leeward Islands.* Oxford Forestry Memoirs, 21. Oxford University Press.
- Box, Harold E. 1939.** *A note on the vegetation of Redonda, B.W.I.* Journal of Botany, British and Foreign, Vol. 77, No. 923.
- Government of Antigua and Barbuda. 2012.** *Census 2011: preliminary data results.* Ministry of Finance, the Economy and Public Administration Statistics Division.
- Harris, D. R. 1965.** *Plants, animals and man in the outer Leeward Islands, West Indies – an ecological study of Antigua, Barbuda, and Anguilla.* University of California Press.
- Howard, R. A. & others. 1977.** *Flora of the Lesser Antilles. Pteridophyta.* Arnold Arboretum, Harvard University.
- Island Resources Foundation, 1991.** *Antigua and Barbuda country environmental profile.* Caribbean Conservation Association.
- Lindsay, Kevel. (In Prep.).** *The ferns of Antigua, Barbuda and Redonda: an atlas and illustrated guide to the native and naturalised pteridophytes.* Environmental Awareness Group.
- Lindsay, Kevel & Bruce Horwith. 1997.** *A biodiversity profile of Antigua, Barbuda and Redonda.* Island Resources Foundation.
- Lindsay, Kevel & Bruce Horwith. 1997.** *A vegetation classification of Antigua, Barbuda and Redonda.* Island Resources Foundation.
- Lindsay, Kevel. 2012.** *Protecting native pteridophytes in Antigua, Barbuda and Redonda: a conservation perspective.* Environmental Awareness Group.
- Lindsay, Kevel. 2012.** *Regional Red List of pteridophytes of Antigua, Barbuda and Redonda.* Environmental Awareness Group.
- Lindsay, K. & Horwith, B. 1997.** *Plant species of Antigua, Barbuda & Redonda.* Island Resources Foundation.
- Loveless, A. 1960.** *The vegetation of Antigua, West Indies.* Journal of Ecology Vol. 48, No. 3.
- Pratt, Christopher, Kevel Lindsay, Melanie Pearson & Carolyn Thomas. 2009.** *The Wild Plants of Antigua and Barbuda: an Illustrated Field Guide to the Native and Naturalised Vascular Plants.* Environmental Awareness Group
- Wheeler, L. Eichmond. 1916.** *The botany of Antigua.* The Journal of Botany, British and Foreign, Vol. 54.