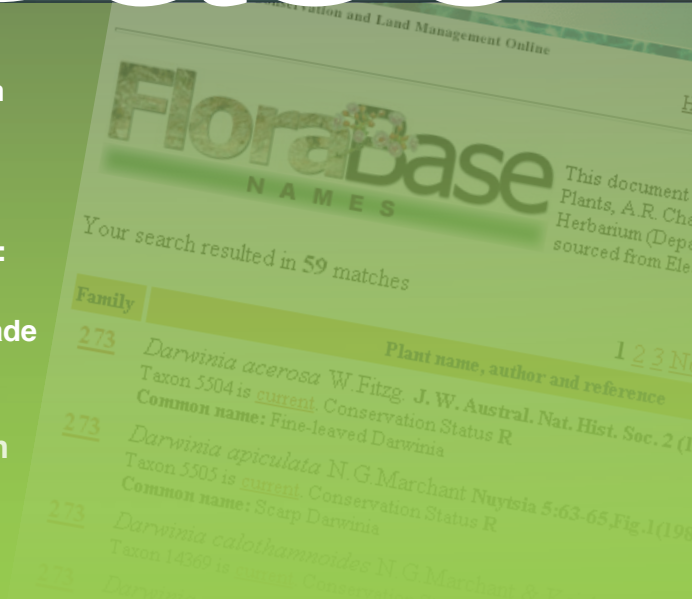
Twenty years of FloraBase

The internet and the ability to immediately access information has become entrenched in our day-to-day existence, but 20 years ago the world was just discovering its potential. A group of visionary scientists at the department's Western Australian Herbarium embarked on an ambitious undertaking: to create the first online Western Australian flora database. And thus was born FloraBase, which is entering its third decade and remains a relevant and invaluable source of information.

by John Huisman, Alex R. Chapman and Ben Richardson



Opposite page
Main Red and green kangaroo paw is one of WA's more than 14,000 recorded flora species.
Insets from top Silky cornflower, WA christmas tree, copper cups.
Photos – David Bettini
Below background The first incarnation of FloraBase was launched in 1998.

Above left A specimen of painted lady (*Gompholobium scabrum*) collected from King George Sound in 1791 by Archibald Menzies and donated to the WA Herbarium by the Natural History Museum, London.
Photo – DBCA

Above WA Herbarium database team and volunteers have input data for 790,000 plant specimens since FloraBase was launched 20 years ago.
Photo – Donna Swan, circa 1996

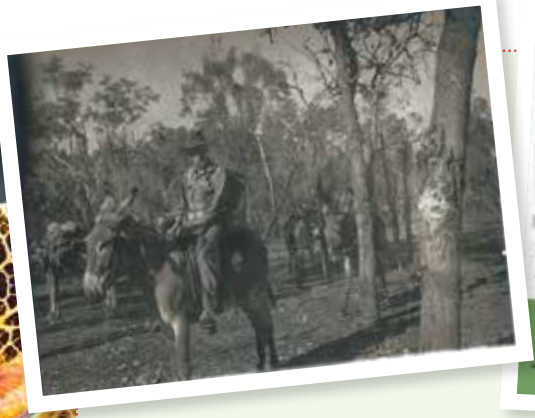
The Western Australian Herbarium, part of DBCA, houses the world's largest scientific collection of Western Australian plants, with some 790,000 dried plant specimens. These specimens provide the foundation for understanding WA's flora, including its composition, distribution (spatially and chronologically), and taxonomy. As permanent records of where and when species occurred, these specimens are the primary resource for research on the classification and distribution of the flora. Amongst the collection are a significant set of 'type' specimens, those that anchor in physical form the concept of a species name and against which all other specimens can be compared and evaluated.

Prior to the establishment of the Western Australian Herbarium in 1929, scientific collections were commonly sent to overseas herbaria, or later to those in the Royal Botanic Gardens of Melbourne or Sydney. Of course species, and therefore taxonomic research, are not restricted by political boundaries and so the WA Herbarium plays a crucial part of the global scientific endeavour to document and refine our understanding of the world's flora, especially important in the world's oldest landscape, which contains one of the 33 global plant biodiversity hotspots.

A PRICELESS COLLECTION

The specimen collection currently occupies four large vaults at the Keiran McNamara Conservation Science Centre in Kensington. The collection is stored securely, under strict quarantine to prevent ingress of potentially damaging pests, and is sequenced systematically, based on an understanding of plant phylogeny, so that closely related plant families are near to each other. This facilitates ease of access and comparative analysis between related organisms – like a giant physical database of biological knowledge. Botanists and technicians work within and around the collection to identify, research, curate and conserve the specimens, keeping the data they contain up to date and secure.

Apart from physical access to the material, information about the flora has traditionally been available via scientific publications such as papers, Floras (see 'Flora versus flora, Herbarium versus herbarium' on page 21), catalogues and handbooks. However, the incredible diversity of the Western Australian flora,



Insets far left Charles Gardner surveying the Kimberley, circa 1950.
Photo – Howard Coate, courtesy Kevin Coate

Left FloraBase remains the only authoritative source for information about WA's flora.

Far left Royal hakea.

Below Queen of sheba orchid.
Photos – David Bettini

Opposite page
Right The stunning wildflowers at Frank Hann National Park.
Photo – Sallyanne Cousans

The road to FloraBase

1930–31 Government Botanist Charles Gardner (Herbarium Curator from its establishment in 1929 until 1960) published a census of all plants known to occur in Western Australia, titled *Enumeratio plantarum Australiae occidentalis*. 4500 species were recorded.

1965 Publication of the *Descriptive Catalogue of West Australian Plants* by Kings Park Director John Beard. This catalogue was based on the incomplete manuscripts of Charles Gardner's *Flora of Western Australia*, augmented by label information on specimens in the Herbarium collection.

1981, 1985 Curator John Green (1975–1987) established an electronically stored updated census, which was the basis for the books *Census of the Vascular Plants of Western Australia* (Edition 1 in 1981, Edition 2 in 1985). The second edition listed 7954 Western Australian plant species.

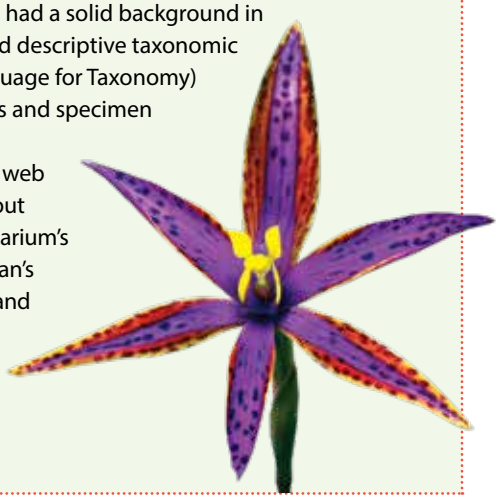
1990 Herbarium botanist Nicholas Lander converted the Green census into a proper database format from which he published a number of supplements to the census. Initiated by new curator Jim Armstrong (1989–1992), Alex Chapman and Paul Gioia began the design and development of the corporate relational plant names database (WACENSUS) that covers all known Western Australian plants, which to this day is maintained and updated by Herbarium staff.

1985 Herbarium specimen label data (now with attached barcodes) began to be entered into a database named WAHERB, one of the first Australian herbaria to embark on this path. By storing this information electronically the collection could be quantified, managed and interrogated much more efficiently. For the first time instantaneous access to all the label data for every specimen in the herbarium was possible, making the classification, indexing, and updating of the data immensely more efficient. All specimens then in the collection were databased by 1994, and as the collection expands this process remains integral to its management.

2000 *The Western Australia Flora: a descriptive catalogue* by Herbarium botanists Grazyna Paczkowska and Alex Chapman is the last of the catalogues in printed form. In addition to his botanical knowledge, Chapman had a solid background in computer science. He and Paczkowska captured descriptive taxonomic information using the DELTA (Description Language for Taxonomy) data standard, and combined it with the census and specimen database.

1995–1998 The construction of FloraBase – a web portal providing rapid access to information about Western Australian flora, incorporating the Herbarium's census, specimen data, Pazckowska and Chapman's descriptive catalogue, along with plant images and Paul Gioia's specimen distribution maps.

11 November 1998 FloraBase was launched. For the first time, complete taxon profiles for every Western Australian vascular plant species are available online.



and the continuing discovery of novel species as new areas are surveyed, has meant that a book documenting WA's complete flora has never been realised. Given the enormity of the task, Herbarium botanists decided that a different approach was needed, and in the early 1990s the concept of a web-based record was mooted. As is true for all Floras, a portion of the contents is drawn from the past, and updated to reflect current taxonomic concepts. FloraBase, similarly, drew on a long history of botanical studies.

A SIGNFICANT MILESTONE

Since FloraBase's inception 20 years ago, it has been extensively refined and updated, and now incorporates not only the vascular plants but other taxonomic groups including the fungi and algae. Significant additions in later versions include an interactive key to the WA genera, the incorporation of the Herbarium journal *Nuytsia*, an upgrade to the maps, and support for tablets and smart phones. Each year a summary of statistics is presented, with the most recent conservatively indicating that the flora comprises close to 13,000 native species, in addition to nearly 1300 alien species. FloraBase remains the only authoritative source for information about WA's flora.

The success of FloraBase is largely due to the foresight and efforts of Alex Chapman, Ben Richardson, Paul Goia, and Nicholas Lander who conceived the idea in the days of the Department of

Flora versus flora, Herbarium versus herbarium

The 'flora' is the plant life present in a particular region, or at a particular time. A 'Flora' of a region, however, is a published compilation, hopefully comprehensive, of information pertaining to the plant species occuring in the region. Floras typically include names and pertinent nomenclatural information, descriptions, keys, and illustrations. In addition to providing a snapshot of current knowledge, a well-written Flora should enable the reader to identify the plants occurring in the region. Historically, Floras have been published books, but increasingly they are being delivered online (such as FloraBase).

A 'herbarium' is a collection of dried plants, which is often used in schools for teaching botany or kept by wildflower enthusiasts for their own interest. A 'Herbarium' is a botanical research institution, which in addition to housing, maintaining and databasing an official collection, is responsible for naming and describing plant taxa. This information is, for the most part, made freely available.

Conservation and Land Management, as well as contributions from numerous Herbarium botanists and curation staff, and volunteers who provide and curate images. The Herbarium's core datasets, which provide nomenclatural and specimen data to FloraBase, are regularly maintained and updated, with the aim of presenting the WA flora aligned to the most up-to-date, accepted taxonomy. Plant taxonomy is still a vibrant field of research, particularly now with the incorporation of DNA sequencing in systematic studies, and new species and taxonomic revisions are a common occurrence. Much of this taxonomic work is published in *Nuytsia*, which is freely available online via a link on FloraBase. However, studies of the WA flora are not exclusive to *Nuytsia*, and keeping abreast of the current literature is an ongoing task for Herbarium staff.

It is significant to the development and position of FloraBase to note that the WA Herbarium has had a long and consistent involvement in the Taxonomic Databases Working Group, an international body devoted to the development of biodiversity data standards and their implementation. Terry Macfarlane, Nicholas Lander, Alex Chapman, Kevin Thiele and Ben Richardson have all played a role in the work of this group over the past 20 years, culminating in the hosting of the international annual conference in Fremantle in 2008.

In addition to providing this information directly, FloraBase data can be accessed via other websites that aggregate data, such as the Australasian Virtual Herbarium (AVH), which provides specimen-based data for the more than eight million specimens of plants, algae and fungi housed in Australian and New Zealand Herbaria. The AVH is a collaborative project developed under the auspices of the Council of Heads of Australasian Herbaria.

A broader coverage, including all of the Australian plants and animals, is provided by the Atlas of Living Australia (ALA), which provides online access to many millions of occurrence records. Unlike FloraBase and the AVH, in which all records are based on specimens held in Herbaria, the ALA also includes observational records.

THE FUTURE

To this day FloraBase remains a popular resource, with almost 24,000 unique users accessing the application across 28 days in September 2018. The department is constantly striving to maintain FloraBase's relevance and a major revision is currently underway, ensuring that it continues to be a valuable resource for scientists as well as the general community. The last five years has seen an upsurge in the use of tablets and smart phones, with almost half of visitors accessing the site with a mobile phone. It is important that these changes in technology and user preferences are monitored and catered for in updates to the site.

Imminent improvements include the provision of a considerably expanded image library, with a 10-fold increase in the number of images available to users (from about 7000 to about 70,000); zoomable maps with links to the underlying data as well as other mapping tools; and updates to the descriptive catalogue dataset to further enhance search results. With these improvements, and many more planned, FloraBase will remain the first port of call for information about the WA flora for many years to come.

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You can access FloraBase at florabase.dpaw.wa.gov.au.

Readers interested in the history of botanical research and the Western Australian Herbarium should seek out A botanical journey. The story of the Western Australian Herbarium *by Roger Underwood (2011), and published by the then Department of Environment and Conservation.*