

# Developing an Interactive Plant Identification Tool for the Royal National Park

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This paper describes the development of an educational resource to help the community identify and understand the native flora of the Royal National Park. The resource, titled 'Coastal Plants of the Royal National Park', is an electronic identification tool available on CD-Rom. The resource features an interactive identification tool with multi-entry keys, a look-up glossary and over 1,200 photographs to support identification of 300 plant species, representing about one-quarter of the Royal National Park's total native flora. It was initiated and developed as a volunteer project by the Australian Plants Society, Sutherland Group to produce a user-friendly resource specially designed for non-botanists. It demonstrates community engagement in environmental education. Over 1,400 CDs have been distributed since the launch in 2006, indicating considerable success in achieving the project aims.

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## INTRODUCTION

Plant identification is a specialist task, typically requiring tertiary education and/or years of experience for individuals to achieve proficiency and expertise. This, together with the richness of plant species in many Australian landscapes including the Sydney region, can make it difficult for interested non-professionals to identify native flora and develop their understanding. Resources for professional botanists refer to complex technical details of plants (e.g. Pellow et al. 2009). While there are well-used guides with keys (Robinson 2003) and photographs for plants in the Sydney region (Fairley and Moore 2010), there is still a need for identification resources for the community that minimise complexity while providing reasonably certain outcomes for species identification.

Identifying and responding to these needs, the Australian Plants Society (Sutherland Group), a community group, developed an educational resource to help the community to identify and understand native flora in the Royal National Park. The coastal

portion of the park was identified as a focus for the project because of high visitor numbers and because its flora is diverse yet manageable for a comprehensive treatment. Many of the plants are also typical of those found in Sydney sandstone in other areas of Sydney. This paper describes the development and features of the identification resource, 'Coastal Plants of the Royal National Park CD-Rom', and its dissemination to the community, highlighting community engagement in both identifying the need for the resource and completing the project on a volunteer basis.

## DEVELOPMENT OF THE EDUCATION RESOURCE

### **Project concept**

The project concept was originally developed by a member of the Australian Plants Society (Sutherland Group), Doug Irving, with the aim of creating a product which would help non-specialists such as himself to identify native plants. Doug Irving used books and printed keys for identification, but wanted to improve on the printed tools available in

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the early 2000s. The central tenet of his concept was to promote community education and engagement by producing an informative, comprehensive and diagnostic, identification guide to plant identification that is more accessible and user friendly to non-botanists than existing books and plant keys.

Sutherland Group of the Australian Plants Society (formerly the Society for Growing Australian Plants) assembled a project team to develop the concept as a voluntary project. The Society is an active community organisation, established in 1958, which aims to increase and disseminate general knowledge of Australian native plants. The Sutherland Group was established in 1963 and has an active program of activities including monthly meetings with guest speakers, walks, garden visits, and working bees at Joseph Banks Native Plants Reserve at Kareela. The principal project team comprised Doug Irving, Margaret Bradhurst, Gwen Caddy, Rhonda Daniels, Connie McPherson, Aileen Phipps, Doug Rickard and Ruchir Sodhani, with additional support from many other people as required. The team had skills in project management, plant identification, computer programming and information technology, education, photography and marketing.

### Project specification

The project team engaged fellow members of the Australian Plants Society to help frame the scope and structure of the identification resource specially designed for non-botanists. A range of options for the design and specifications of the resource were discussed at a series of meetings to obtain input from a sample of potential users. Draft features of the software were demonstrated, with participants testing modules of the software as versions were developed. Meetings were also held with professional botanists with experience in development of keys and teaching plant identification. This input ensured technical accuracy from the design phase and provided valuable feedback through demonstrations of draft software at various stages of development.

Several key specifications for the identification resource emerged from this iterative consultation and trial process:

- the resource should have an explicit geographic scope and include the most common plant species found in that area
- descriptions of plant species should be both pictorial and written, with the latter highlighting diagnostic plant features that are essential to distinguish each species from others
- the identification process should be flexible, allowing users multiple points of entry based on

features that their skills and season of visit permit them to observe

- the identification process should allow users to view a list of species that match the features that they observe, and progressively reduce this list as more features are observed
- technical botanical terms should be avoided but, where essential, should be explained in an accessible, plain-language glossary.

The geographic scope of the project focussed on the flora seen along the Coast Track in the Royal National Park. The Coast Track covers a wide range of habitats, from coastal dunes in the north, through sandstone landscapes and the shale escarpment in the south, traversing through heathlands, wetlands, woodlands, eucalypt forests and rainforests. Although a broader geographic scope encompassing the entire Park was not feasible, many plants in these coastal habitats are also found in other parts of the Royal National Park and elsewhere in the Sydney Basin.

### Project development

An initial set of plant species in the area was compiled from lists of species prepared for various locations in Royal National Park and Sutherland Shire by the late Pat Akkersdyk, also a member of the Australian Plants Society (Sutherland Group). This initial list was subsequently checked and refined through field reconnaissance of the Coast Track by members of the project team. A total of 300 plant species were ultimately included in the identification resource.

The field trips also provided opportunities to take photographs of each species and document features such as habitats and flowering times. Multiple trips were undertaken at different times of year to take photographs of the plant, leaves, flowers, fruits and, where relevant, bark, with an average of four photographs for each plant species and 1,200 in total included in the resource.

A set of diagnostic features for each species was compiled in a table from published sources (Harden 1992, 1993, 2000, 2002), field observations and consultation with experts. The features were grouped into six types: flowers, fruit, leaves, bark, plant type and habitat. The focus was on descriptions that would be useful to and identifiable by community users. Characteristics were intended to be observed in situ without the need to collect specimens or disturb habitat. Flowers were described in terms of colour, flower shape, flower form, petal/sepal number, or flowering month. Fruits were described in terms of type, colour and other features (fleshy, hairy, hard, ribbed or woody). Leaves were described in terms

of arrangement, type, shape, length, margins and attachment. Plant type was described as tree, shrub, herb/orchid, climber/scrambler, or sedge/rush. For non-flowering plants, the different set of features for ferns includes trunk, frond form, frond length, sori arrangement and rhizome type.

Computer software was programmed to implement identification, search and query functions, drawing on the attribute table and the photographs (described in detail below). The software was designed to run on Windows operating systems. Functionality was extensively tested by members of the project team and external experts.

The project received financial support from the federal government's Natural Heritage Trust Envirofund with a \$5,060 grant in 2002, and from the Australian Plants Society NSW through the Lisle Pearce Bequest Fund (\$900) and from Sutherland Group. These grants funded travel and photography costs, a GPS device to record locations, and the production costs of the CD-Rom.

#### FEATURES OF THE IDENTIFICATION TOOL

The main screen of the identification resource 'Coastal Plants of the Royal National Park' features seven menu tabs across the top of the screen providing access to introductory information about Royal National Park and its environment, the main search tool, the photograph gallery, glossary, habitat descriptions, supporting information and help functions. The key features of the search tool and the species gallery are described below.

##### **Search tool**

The Search tool (Fig. 1) is the main feature of the interactive identification software. On the left hand side of the main screen (Fig. 1), the software allows the user to select (by ticking a box) the observed characteristics of a plant to be identified. For flowering plants, the characteristics are arranged in collapsible hierarchical menus for flowers, fruit, leaves, bark, plant type and habitat. There are several options for each of these features. For instance, the flowers can be described in terms of colour, flower shape, flower form, petal/sepal number, or flowering month. Within flower form, the three options are single, cluster, and spike, and within flower shape the six options are regular, irregular, globular, cylindrical, pea, and tubular/bell-shaped. Fruit can be described in terms of type, colour and other features (fleshy, hairy, hard, ribbed or woody). Leaves can be described in terms of arrangement, type, shape,

length, margins and attachment. Ferns have their own sets of features including trunk, frond form, frond length, sori arrangement and rhizome type (creeping, erect, underground).

The list of possible characteristics is very long when all the options are displayed, but not all features have to be selected and described for each plant to be identified. The software works best when only the five or six most distinctive characteristics of the plant are chosen. The characteristics and written descriptions use common terms to make identification accessible to non-specialists, and the software also includes a glossary describing the terms such as simple and compound leaves, and regular and irregular flower shape, sometimes illustrated by line drawings.

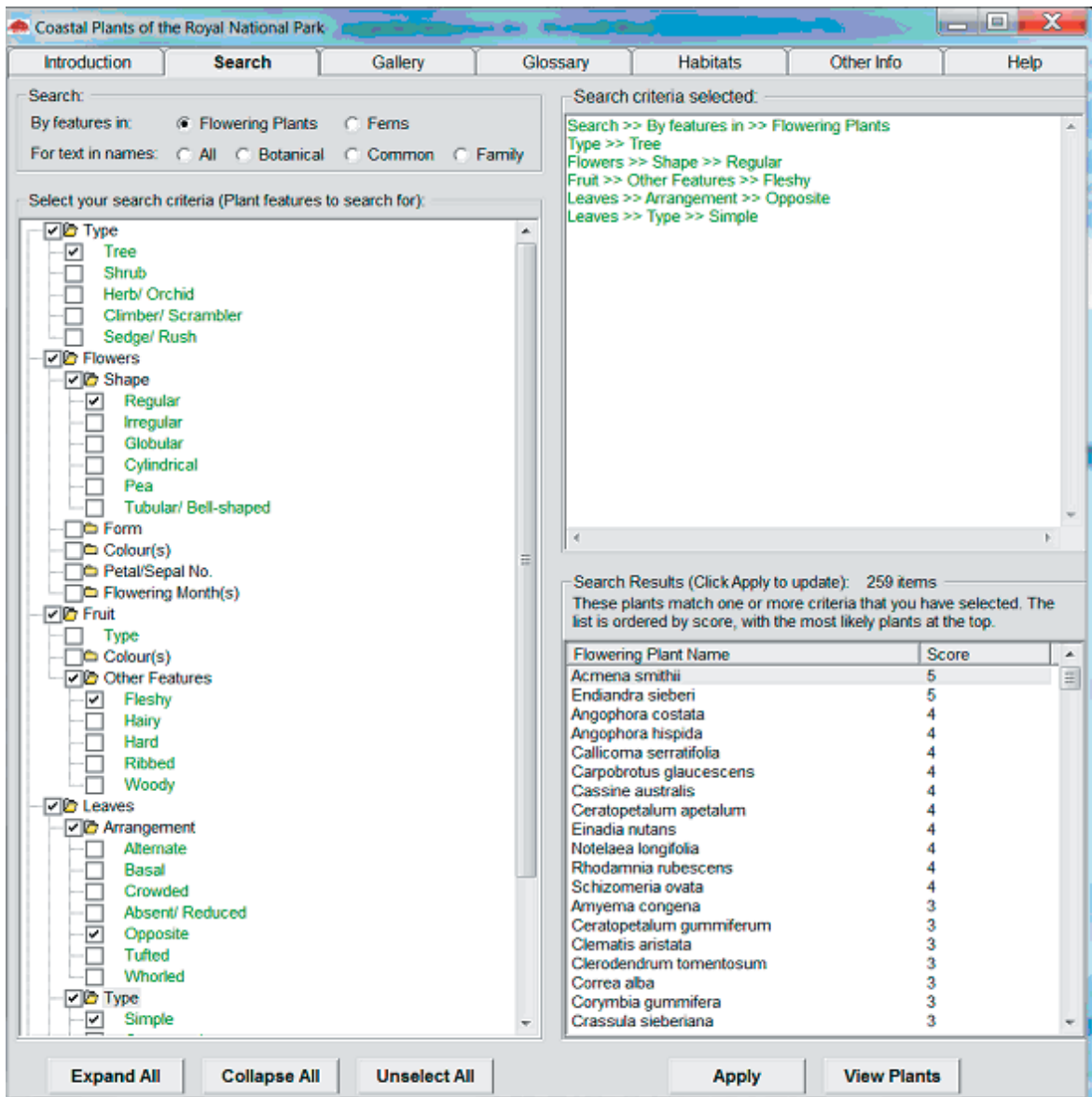
The user's selections of characteristics are summarised in the top right window (Fig. 1). The software then matches those selections across the database of characteristics for each of the 300 plants and produces a list of plants which share those characteristics, shown in the bottom right window of the main screen (Fig. 1). The list also includes a score indicating the number of selected features that match each species. By selecting each of the most likely species on the list and clicking the 'view' button, users can visit the gallery to visually match photographs and examine written descriptions of each feature to confirm the identity of the species (see below).

The interactive identification software is specially designed to support users who are not botanists. Traditional plant identification keys require users to make many sequential "yes" or "no" decisions. If users make the wrong decision early on, they may finish on the wrong branch of a hierarchical tree. The software is based on the weight of evidence from multiple characteristics. Each characteristic selected, such as flower colour=yellow or fruit type=berry, scores a "1" if it matches the feature as recorded in the tool's database. The subset of species in the database with the highest number of matches are listed in descending order, and the user can look at the photographs in the gallery (described below) to confirm the identification.

Although the main identification pathway is by selecting the characteristics of a plant as described above, users can also search a plant name – either the botanical name, common name or family name. This allows the user to query how many species with a given name (such as Acacias or Banksias) are amongst the 300 coastal plants included in the guide or to go directly to the gallery to examine written and photographic descriptions (see below).

Use of the software is illustrated by reference to the plant featured on the CD-Rom disk and case,

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**Figure 1. Identification search tool showing character menus with selections and candidate plant species scored by the number of character matches.**

*Epacris longiflora*. This species can be described by up to 14 characteristics of the flowers and leaves, but the species could be identified correctly with fewer characteristics such as flower shape=tubular, flower colour=red, leaf length=tiny leaves, leaf other feature=sharp tips, and habitat=heath. Other plants, including other *Epacris* species, also share some of those characteristics, but these alternatives may be evaluated using the scoring matches and the photograph gallery (see below). The matching approach allows non-specialists to make mistakes in

describing a plant, but still generate a list of the most likely plants. The database accommodates natural variation in plants in different conditions, and for user uncertainty in describing plants. For instance, six characteristics may be selected including flowering month=May. No plant in the database may have those six characteristics. But a plant with five of those characteristics, but with flowering month=April, may be the correct plant based on scores and verification against the photographs and written descriptions.

**Photograph gallery**

The gallery (Fig. 2) is designed to be used in conjunction with the identification tool to confirm identification by visual matching. The gallery contains over 1,200 photographs of the 300 plant species. The available photos for each species are listed across the top right of the gallery screen. Each photograph may be selected and enlarged to full screen size. For each plant, there are usually four photographs showing the growth form of the plant, the leaves, flowers and fruit or bark. The gallery also contains a text description of each plant, on the left hand side of the screen. The

text gives the family, genus, species and common name and is arranged in a standard format for each species with descriptions of the plant type, flowers (including flowering time), fruit, leaves, bark (where appropriate) and habitat. The description also gives the origin of the botanical name and includes a table summarising the full set of characters in the database. This information allows users to browse through the plausible identification alternatives and select the species that best matches their observations in the field.

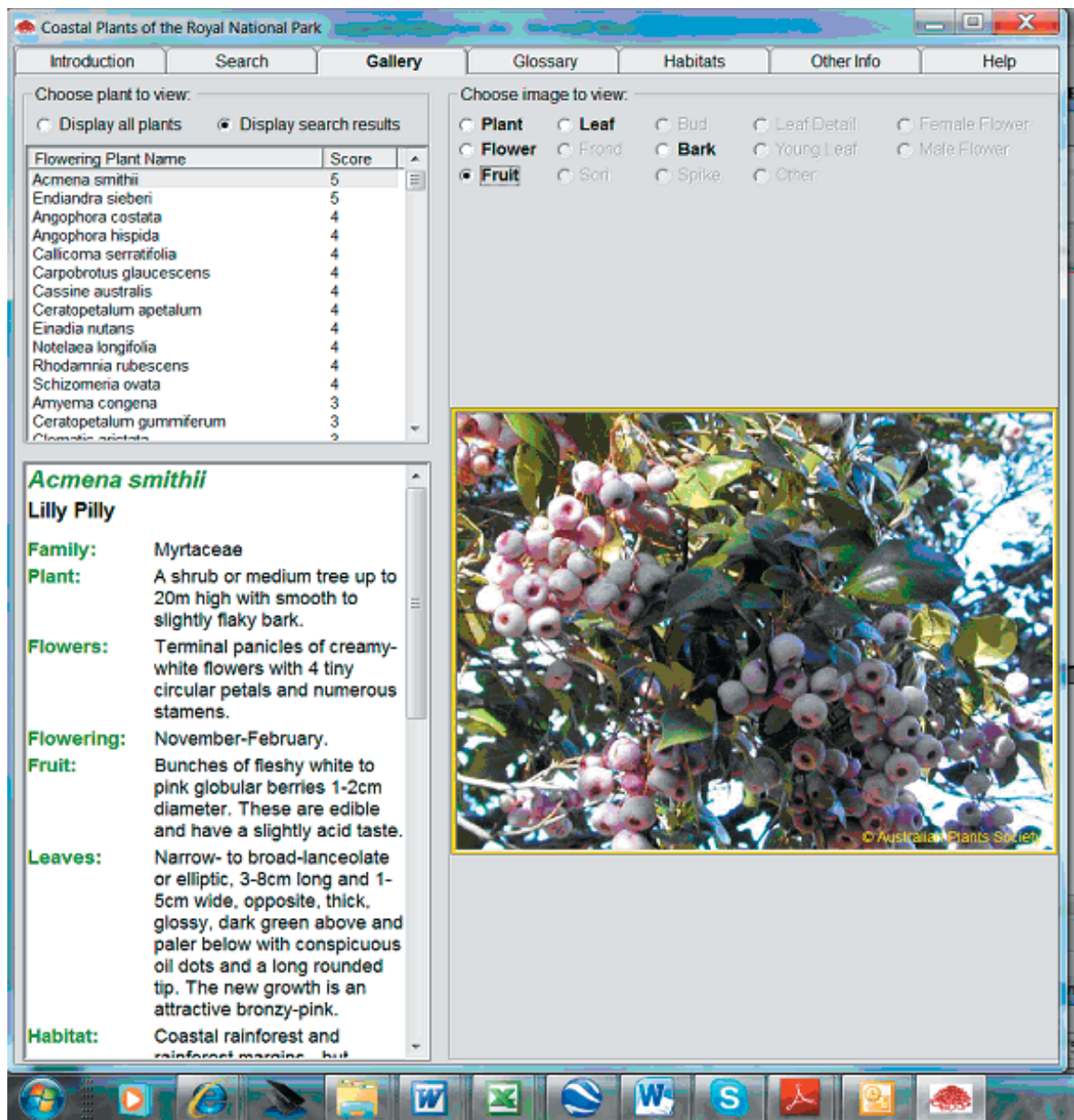


Figure 2a. Gallery showing the text description and photographic images of fruit for one of the the top two candidate species in Figure 1, *Acmena smithii*.

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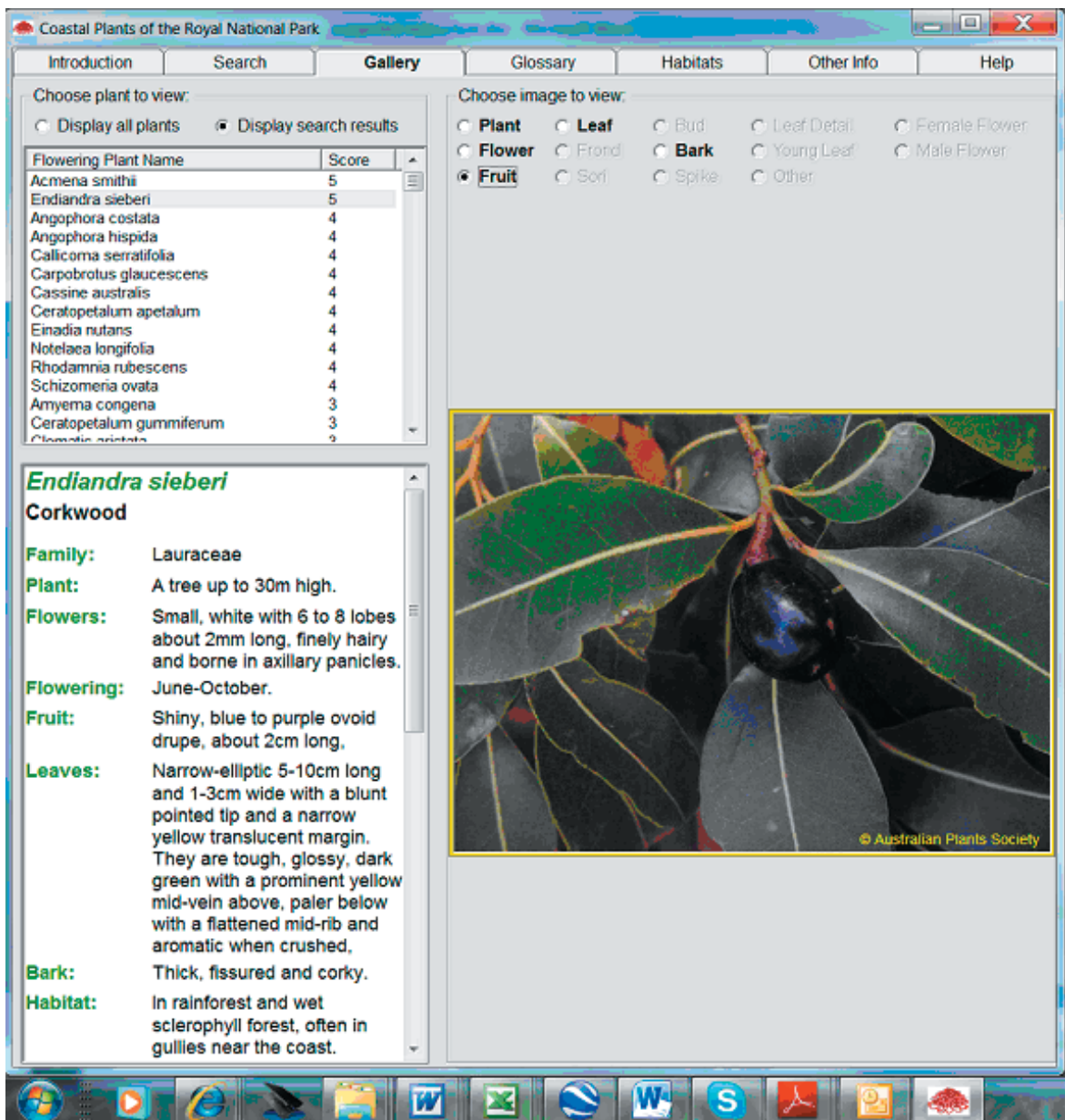


Figure 2b. Gallery showing the text description and photographic images of fruit for one of the top two candidate species in Figure 1, *Endiandra sieberi*.

### Other features

The identification resource has several other features to assist identification including a Glossary, with a plain English description of common botanical terms, and often with a line drawing. It also includes descriptions of the main habitat types in the Royal National Park including rainforest, wet sclerophyll forest, dry sclerophyll forest, heathland and beach strand. Other features designed to enhance utility to users include printable sheets containing identification guidelines, a data collection form and an identification

guide. It also features lists of plants in the database, and relevant references. The Help function is structured by Frequently Asked Questions.

### DISSEMINATION OF THE EDUCATION RESOURCE

#### Launch

An important aspect of the project was the dissemination of the CD-Rom to the community.

The project was officially launched on 25 November 2006 at Audley in the Royal National Park by environmentalist Bob Walshe OAM, Patron of the Sutherland Shire Environment Centre. The launch was attended by local politicians and Sutherland Shire Councillors, staff of the National Parks and Wildlife Service, members of the Australian Plants Society including the project team, and members of the local community.

The launch was featured in the local newspaper, *The St George and Sutherland Shire Leader* (Field 2006). Other publicity for the resource included an article on Doug Irving in *The Sydney Morning Herald* (Galvin 2006), an article in *Burke's Backyard* magazine (Burke 2007), and articles in Australian Plants Society publications such as *Native Plants for New South Wales* quarterly journal.

#### **Dissemination to the community**

Copies of the CD-Rom were deposited with the National Library of Australia, the State Library of NSW and Sutherland Council Library. The CD was disseminated in several ways including direct sales from the Australian Plants Society and through commercial outlets. During the five years since the launch in November 2006, over 1,400 copies of the resource have been sold with a recommended retail price of \$20. The price was chosen to convey a value for the product but make it affordable to the community. A marketing strategy was developed to identify likely markets and promotion approaches.

Direct sales were made from the Society's website (<http://sutherland.austplants.com.au>) and through presentations by Sutherland Group members to other community and environment groups such as Australian Plants Society groups, Probus, Rotary, National Parks Association, Friends of the Botanic Gardens, gardening clubs, bushwalking clubs, Sutherland Shire Bushcare and environmental education groups. A powerpoint presentation was developed so different members could present the CD, share the story of its development and demonstrate the interactive identification features.

About half the CDs have been sold through commercial outlets such as the Royal National Park Visitor Centre, the Botanic Gardens shops, Sydney Wildflower Nursery at Heathcote, Florilegium bookshop, Sutherland Council Nursery, and other local outlets. The CD has been very well-received, shown by the repeat orders by the retail stockists. The CD has been purchased by people in Sutherland Shire, Sydney and beyond, including schools, botanists, people living outside Sydney and tourists.

In hindsight, the title of Coastal Plants of the

Royal National Park may have limited the market. Although focusing on the plants seen along the Coast Track in the Royal National Park, the collection of plants on the resource represents plants which are found throughout Sydney on Sydney sandstone and a broader title may have conveyed this to potential buyers. It was also difficult to convey to some potential buyers the nature of the tool – that it was a piece of software for the computer, not a CD or video to watch on television. The best way to convey the tool and the identification features was a live demonstration.

#### **FEEDBACK AND FUTURE DEVELOPMENT**

##### **Community feedback**

The total sales since the launch show that the resource is meeting a need in the community for an educational resource on identifying Australian native plants. The CD is being used in various ways in the community. Two examples of feedback illustrate the different uses of the resource.

Scout Group leaders from Hurstville wrote: "Thank you for the good work with putting the CD together. Hubby and I love walking in the Royal and this CD will certainly help us to identify some of the beautiful plants we see but have little idea about their names. I can also help our Cub Scouts to learn more."

Wakehurst Public School in the north of Sydney produced a brochure on Duffys Forest plants. The School wrote: "I would like to thank you so much for allowing us to use the marvellous photos on the CD-Rom. Being able to use these greatly enhanced the quality of the booklet we produced. This booklet is a K-6 environmental education program where each child will learn at least one tree, shrub and groundcover per year."

##### **Future developments**

Sutherland Group is working on further developments to the resource including an online version, an extension to include more plants, and information on Aboriginal uses of plants. A simplified demonstration version of the tool was made available on the Sutherland Group website (<http://sutherland.austplants.com.au>) in February 2012. It offers some limited features of the many searches available on the CD-Rom, but does not have the full search capability of the CD-Rom, particularly as it only lists plants which match all the selected criteria. There has been interest from other groups in developing the tool for their own uses such as a database on local plants in their area or for other aspects of the environment such

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as birds. Sutherland Group is willing to make the software available with step-by-step guidance to assist other groups that aim to produce similar products for other areas. As the database is programmed in an expandable format, new applications can start small, with more plants added over time. Size is limited more by the resources required to compile information and photographs, rather than software limits.

### CONCLUSION

The electronic interactive identification resource, *Coastal Plants of the Royal National Park*, was initiated by an enthusiastic community member who wanted to learn more about Australian native plants and improve identification, and was completed as a volunteer project involving many members of the Sutherland Group of the Australian Plants Society. The project is a demonstration of community engagement in environmental education, with the community, through Australian Plants Society members, identifying the need for the project, developing the project and then disseminating the resource to other community users where it has been well-received. Two key strengths of the project underpinned its success. Firstly, dedicated project team members contributed over 4,000 volunteer hours over several years to ensure the ambitious project was completed. Secondly, early and continuing collaboration and consultation with professional botanists and community members who would use the product ensured the scientific accuracy of the product and its relevance to end users.

Sutherland Group of the Australian Plants Society is proud to have used the Royal National Park as an education resource and produced an electronic interactive identification tool to help the community learn more about native plants in the Park and beyond. It is likely the resource is being used in educational ways Sutherland Group had not imagined.

### ACKNOWLEDGEMENTS

This paper is written on behalf of Sutherland Group of the Australian Plants Society. Member Ralph Cartwright presented the paper at the Symposium on the Royal National Park in September 2011.

The concept of a plant identification tool for the general community was developed by Doug Irving, who joined Sutherland Group in the late 1990s towards the end of his academic career in a non-botanical field. He was very enthusiastic about Australian native plants, and keen to learn more using available tools including books and

printed keys. Doug Irving and Margaret Bradhurst took the photographs and Doug designed and programmed several developmental versions of the software. Doug Irving, Margaret Bradhurst, Gwen Caddy, Connie McPherson and Aileen Phipps walked the Coast Track in the Royal National Park many times in different seasons to identify all the plants seen, record their features and photograph each of them at different stages.

When Doug Irving died in December 2003 before the project was completed, Sutherland Group completed the project as a team effort, with Doug Rickard co-ordinating the project. Ruchir Sodhani was responsible for refining and completing the software, with involvement from Doug Irving's son Frazer. Project team members checked information, tested many iterations of the software, prepared the glossary of terms (Aileen Phipps) and produced line drawings to illustrate the glossary (Ken Smith). External experts including Belinda Pellow and David Keith provided advice on design of the resource and other scientific issues and also tested the resource.

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