

THE USE OF HAND HELD TABLET LAPTOPS TO RECORD LIVING COLLECTIONS

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Plant records in botanic gardens are very important and are one of the factors that distinguish them from other types of plant collection. Stocktaking, to ensure that the records held in the database are reflected in the actual plants growing in the Garden, is a particularly important but very time-consuming process. The Royal Botanic Garden Edinburgh is experimenting with a ruggedised laptop connected to the main database by using a wireless connection and mobile phone technology so that records can be updated 'live' in the garden. This paper describes the issues and lists the specification of the equipment being tested.

INTRODUCTION

One of the main factors that separate plants held in a botanic garden collection from plants in other collections is the quantity of information held about the plants themselves.

From the moment that seed is collected for a botanic garden collection from a living plant in the wild, information about it must also be collected. This might typically include the date of collection, the names of the person or persons who were present, the location of the parent plant, soil types, associated flora, local uses, descriptions, photographs (of plant and habitat) and more. In addition to this, a dried specimen is normally collected, pressed and dried for storage in the herbarium. The link to the preserved collection makes identification of the plant easier in the future and provides a back up specimen should the living material fail for any reason. When living plant material is acquired from another botanic garden or collection any stored information must also be passed with the plant to Royal Botanic Garden Edinburgh (RBGE) for entry into the database system.

The collection of this data should continue through the life cycle of the plant and would include, for instance, how propagation was achieved, how long it took to reach the status of a fully grown plant, flowering dates, measurements and any other botanic gardens, universities or institutions that we have passed plant specimens or propagules on to during its life. Records are also made when the plant is examined by a member of the science staff to determine the accuracy of the name given to it in the field. This process is called 'verification' (see Cubey and Gardner, 2003). The final record about any plant in the living collection is the date and, where it is known, cause of death. Despite some reluctance to admit failure on the part of staff, the cause of death can give a useful insight into possible ways to improve collection management, be it planting method, soil type, chemical use or basic plant husbandry, in the future.

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The living collections database used at RBGE is a multi-user version of *BG-BASE*TM, a relational database written specifically for botanical collections. This powerful tool allows curation of all of the material at the four sites managed by RBGE and has fields for storage of a comprehensive range of data. The data is searchable using simple query screens or, for those users with a higher level of training, there is also a search tool, which allows more detailed interrogation of the data.

All of the information held about the collection is available for use by staff members, while other members of the botanical community and the general public have a limited range of access to the data. Staff members can access information directly by interrogating the living collections database. Others may ask for information via email or letter, can look at a simplified copy of the database shown on the RBGE website or can look the plants up in the hard copy listing published as the '*Catalogue of Plants*' which is published every five years (most recent of which is Rae, 2006).

RECORDING THE LIVING COLLECTIONS

Living plants bring their own challenges when collecting information about them. Most museum or scientific collections tend to be fairly static but the living specimens in a botanic garden tend to be moved, die, self-propagate or perennate underground for periods. Any labelling system also suffers at the hands of the weather, large booted horticulturists and the little hands of children. Recording also brings yet more problems as wind and rain make writing difficult and an outdoor environment does not lend itself well to keeping lists. Clipboards stored in the tractor cab or lists folded up in a jacket pocket for safety can easily be forgotten in the rush to keep the garden tidy for the public.

Despite these problems staff are required to complete a planting sheet when plants are moved specifying the accession number and name of the plant in question along with its original and new locations. Staff must also inform nursery staff of any plants being moved from the propagation area into the main garden. Full labelling of the plant in the nursery helps with this, as each plant should have a barcode label either attached to it or pushed into the soil beside it. This provides a very useful double check for any plants missed from the planting lists. Deaths are often noted simply by putting their labels into a 'dead box' in the garden tool shed for later entry on to the database.

Of course it is inevitable that some plants remain unrecorded, which makes it important to perform regular stocktakes of the garden to ensure the most accurate records possible and to ensure that the information presented in the database is mirrored by the reality of the plants in the garden.

STOCKTAKING – PAPER AND CLIPBOARD

Stocktaking has historically been done on paper. Prior to the availability of computer databases, handwritten lists were produced of all of the plants in a given bed, with appendices of missing plants (compared to earlier listings) and unlabelled or unknown plants.

Now, with the use of computer databases, printed lists can easily be produced for each bed and these can be taken into the garden and annotated to show which plants are present and which are missing. Notes on missing plants or any not listed by the computer are then taken back to the office for updating.

In recent years this has been further developed so that each record in a bed is now updated after stocktaking to show the date that each plant was checked and by whom. At this point additional information on the plant's performance can be added, such as whether it was in flower at the time of checking, brief descriptions, leaf cover and rough measurements to help build up a full record of the plants in the collection over time. In this way it is possible to determine not only the last time the record was checked, but also what stage of growth the plant was at on the date of checking. This full update is done in the office from the paper notes taken out in the garden. Although it seems like a very large task, by using the *BG-BASE*TM 'browse list' function, it is possible to move quickly through a set of records with minimal typing. With this function the user selects the plants in a given bed and sorts them in the order that they occur in the bed. The resultant list is opened via the 'plants' entry screen, and each record is brought onto the screen in turn for updating.

DEVELOPMENTS IN TECHNOLOGY

Staff at RBGE and, indeed, in all botanical collections are constantly looking for ideas or ways to make recording events easier. Experiments with a ruggedised computer in the late 1990's did not prove to be particularly useful as the only way to access the database was to produce an output in the office and then export this to the ruggedised machine for annotation. The results still had to be integrated back into the main database back in the office at a later date. Around the same time, a barcode scanner was purchased and programmed in-house to record set event types (such as planting out, plant movements and seed sowing). However, as staff used this they found that they always needed to interrogate the database to check on some plants, and so the system was limited. It was felt that this type of equipment would only be fully useful with live (real time) access to the database while in the garden.

In 2006, with the increasing availability of wireless networking, improved capacity in portable computers and the determination of horticulture management to increase the speed and quantity of plant recording, the subject was revisited. Given the task of testing alternative systems and sourcing the necessary equipment, the database manager began by looking at the options available on the market and borrowing some sample hardware.

ONLINE VERSUS OFFLINE CONNECTION

Due mainly to the limitations experienced with the earlier ruggedised machine it was decided that online access to the database outside the office environment was the preferred option. This gives users the ability to search the database, read outputs and

update records live, while in the garden. The ability to incorporate future developments such as a mapping system was also a large consideration. However, it was agreed that offline access should still be considered along with its inherent benefits and problems to ensure fair comparison.

To work offline requires downloading of a subset of the database to a mobile device. The user is then limited to that data set and cannot query other areas of the garden. The records ‘captured’ must also be locked at that point to prevent another user updating them between the time of downloading and the eventual upload of the new data captured outside. The uploading process itself would need a complex checking system to ensure that the data is sensible. This could be achieved on the existing database although some development time would be needed.

Working online also brings its challenges – in particular the method of connecting to the database in a dependable way and any security issues involved. On the plus side, a single copy of the database is maintained and the logic checks required during data entry are done on a record by record basis as the user uses the entry screens (questions such as ‘am I in the right record?’ which users would ask almost subconsciously, but are not easy to duplicate in a batch process). The user also has the added flexibility of being able to answer random questions posed by other staff members or visitors while out in the garden or glasshouse.

The issue of maintaining a reliable connection over time and with a varied landscape involves a choice between purchasing the hardware to provide an all-encompassing wireless network that incurs minimal running costs or using other technology, such as mobile telephone networks, and incurring higher usage costs without the high investment in hardware. The decision made at RBGE is a hybrid of these two options. Where there is a reasonably wide wireless coverage (such as in and around buildings) then the wireless network is accessed but where the work falls out of the range of the wireless transmitters, then a mobile telephone connection is used.

HARDWARE CHOICE

The hardware used needs to first of all be portable and easy to use. In a garden environment there is also the issue of glare off the screen from strong light and protection of the equipment from damage by adding a rugged casing. A standard laptop could be used and would be relatively low cost while ruggedised versions are much more expensive and also weigh more. Laptops also come with a familiar operating system and so the staff training requirement is minimised. Experience with trial equipment also taught us that standard equipment can easily be damaged but that a ruggedised case causes a significant decrease in usability.

Pocket sized portable equipment was also considered and they proved to provide reasonable computing power in a very portable and affordable form. However, the size of the screen would allow only limited information to be displayed and the system would probably need to be used offline from the main database with specially designed entry screens.

The equipment finally chosen was a ruggedised tablet PC (Fig.1) which runs a standard Windows® operating system and touch screen (plus optional keyboard). It can run the database software as well as any other Windows®-compatible programme. The tablet has bolt on modules for BLUETOOTH® and telephone connections, a harness or hand strap for portability and has sufficient battery life to support a full working day. It also has the ports available to add on extra technology as it becomes available. In conjunction with the tablet, a rugged BLUETOOTH® barcode scanner can be attached to read bar-coded labels. The specifications for this equipment are as follows:

Tablet PC

Itronix Duo-Touch Tablet PC with 1.1 GHz Pentium M processor – 40 Gb Hard drive and 768 Mb RAM with dual mode touch screen.

BLUETOOTH® integrated card – 3G card with RF switch

Expansion Battery

Additional extras – desk mount, soft grip, hand strap, USB keyboard, stylus pack, shoulder strap, carry case, screen protective overlays

Supplied by: www.itronix.com

Barcode Scanner:

Socket rugged BLUETOOTH® barcode scanner

Supplied by: www.thebarcodewarehouse.co.uk



Fig. 1 The hand held lap top showing *BG-BASE™* on the screen. Photo: Lynsey Muir.

NETWORK SOLUTION

It is important to maintain a reliable connection with the database at all times to avoid data corruption and long term locking of records and the method of connecting the tablet to the network was chosen specifically to protect against this. Instead of having a direct connection over the wireless or telephone systems between the tablet user and the database, RBGE opted for a second desktop PC which holds the link to the database over the physical wired network. This second PC then has a wireless link to the tablet. Should the wireless link fail momentarily, then the tablet screen freezes, but as it is merely a 'mirror' of the screen information for the desktop PC, the database connection is unaffected. The connection failure appears to the database just as a break in activity by the user and when the connection is resumed the database is still in the same condition as before the connection was broken and work can continue.

If the tablet computer is out of range of the RBGE wireless network, then it can be switched to use the GPRS or (faster) 3G data system provided by the mobile phone network.

CONCLUSIONS

The equipment is still fairly new to staff at RBGE but initial reactions have been positive. Some changes to work patterns have been required and indeed some tasks still seem easier using the clipboard, especially where it is necessary to move around in



Fig. 2 Janette Latta stocktaking the living collection with the hand held lap top in the area around the Alpine House at the Royal Botanic Garden Edinburgh. Photo: Lynsey Muir.

densely planted areas. More time is spent in the garden overall as the user assesses the plants and does the data entry while outside (Fig. 2) but this is balanced by the fact that data entry back in the office is almost completely eradicated. Labels in the garden are not barcoded and so the scanner is not used in the garden.

There is also the benefit of time saved by responding to queries on the spot. In the past a query by a visitor or member of staff would be noted down and then followed up later by interrogating the database and then either returning to the garden to find the staff member or contacting an enquirer by telephone or mail with the response.

In the nursery area of the garden all work is databased as it happens and since all plants have barcode labels, the barcode scanner helps to improve throughput as well as accuracy. This has resulted in a much more up to date set of records for the nursery collections.

The hardware is also used to run other software, i.e. Health & Safety packages, and it is hoped to expand its use into other areas of Horticulture, including tree assessment, in the future.

REFERENCES

- RAE, DAVID (2006). *Catalogue of Plants 2006*. Royal Botanic Garden Edinburgh.
- CUBEY, ROBERT & GARDNER, MARTIN F. (2003). Targeted verification. *Sibbaldia*. 1, 19–23.

