FILING PHOTOGRAPHIC SEQUENCES IN A DIGITAL DATABASE

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ABSTRACT

Monitoring plant population dynamics efficiently is achieved by repeated sampling at fixed points (Philleps *et al*. 1998). Often accompanying such data are a plethora of pictorial data that are often underutilized in supporting quantitative findings because photographs are forgotten or lost and are often awkward to retrieve and organise. Hence there is a requirement for a system to systematically store and retrieve photographs as an aid in the interpretation of quantitative data especially where photographs are taken as a time series.

This paper outlines an adaptable database and storage methodology that can be used to organise digital photographs associated with plant monitoring sites. This methodology will enable a more efficient use of photos to support research findings and prevent the loss of important ancillary data associated with such samplings. Additionally, this methodology ensures a consistent nomenclature and filing system for storing digital photographs. This paper also demonstrates graphical outputs from the database highlighting the importance of digital photography in monitoring plant population dynamics as the communities respond to imposed management regimes and seasonal variations. It is suggested that this system is very relevant to many researchers and managers as a method of complimenting and enhancing current monitoring systems for recording plant populations within Australian rangelands.

INTRODUCTION

Photographic series have been valuable in illustrating qualitative changes plant communities. On a large scale, changes or stability in landscapes and communities are readily documented using photographs. Examples of both change and stability on a community scale have been presented by Klement *et al*. (2001) and Lewis (2002). Similarly, yet on a smaller scale, changes in permanent transects and quadrats are also readily documented using photographs. However, a stack of jumbled photos is of little use to anyone, similarly in this digital age, directories of photographic files are also meaningless unless some information is known about them. Photographs that are difficult to access or search through also lose their value as a research tool. This issue was highlighted by the need to access long-term monitoring data and photographs accumulated over 30 years by DPI & F's woodland ecology group. All photographs were stored in filing cabinets and after migrating to digital formats, photographs were then stored in directories on hard drives. Perusal and access to photographs was dependent on having the updated version of directories and trolling through directories to find the appropriate files. Information about the photographs was usually stored elsewhere.

Time consuming methods of storing digital photographs indicated a need for a methodology to increase the efficiency and ease of identifying photographs, especially those taken along a time series. This paper outlines a method for storing and retrieving digital photographs.

PHOTOGRAPHIC DATABASE

Development

Numerous software packages are available to store photographs and some data associated with the photos, however, few are sufficiently detailed to store scientific data associated with monitoring photos and fewer appear to be readily available to researchers.

Initially, photographs were included within the monitoring database, DRYAD, developed for the TRAPS (Transect Recording and Processing System) network (Back *et al*. 1997). These digital photographs were included with the site data to provide a visual impact of the data outputs. The inclusion of photographs into this database led to the successful development of a two databases dedicated to storing images and their associated data.

For a database to be effective it must be easy to use, reliable and capable of data sharing while at the same time remain secure and flexible for the users needs. These image libraries managed by MSAccess databases meet these criteria.

Storing images

Images can be stored either within or outside of the database by three methods:

- Storing image as an 'Object Linking and Embedding' (OLE) field and using a bound object frame to view the image. However, this method 'bloats', i.e. size very quickly increases, but not in proportion to the size of photographs stored and the large database size becomes impractical for the number of photographs it is storing. Additionally, this increases difficulty in using files in other applications/ report/ and presentations.
- Another method for storing image files in an OLE field is to store the image as raw binary data, or as a binary large object bitmap (BLOB), extract the image when required and uses an image control to display the image. However, this method requires expertise in coding, is complex and the size of the database can become quite large with increasing numbers of images.
- The third method stores the directory path in a text field and uses an image control to display the image. This method is the easiest and most commonly used technique and the images are physically stored outside of the database. However, entering the path and name of individual image files can be laborious. This problem can be quickly over come in all three databases by using a standardised nomenclature and filing system for images which required minimal operator input. This methodology allows an almost endless capability to store and retrieve large amounts of photo information.

Photographs can be stored in three different directory structures, depending on the type of data associated with the images and personal preferences of the user. Images can be stored adjacent to the database in the same directory, which is utilised for the Photo-Pairs database. Images associated with Dryad and QuadPhoto are stored in subdirectories adjacent to the database. Another alternative is to store images in directories elsewhere on the hard-drive. The important factor in storing images associated with MSAccess databases is consistency.

The database can be very simple, such as QuadPhoto, which stores simple permanent quadrat photographs and minimal associated data. Alternatively, the database can be very complex, such as Dryad, which stores transect photographs, "mud maps", GPS tracks, transect data, site data, climate data, landholder details and also summarises and analyses transect data. Database requirements can be readily adapted to store data and images to the user's requirements and abilities.

PHOTOGRAPHIC OUTPUTS

Forms, Queries and Reports can be used to present different aspects of photographs, which can range from simple to complex, depending on user requirements.

QuadPhoto outputs photographs to view a single photograph on screen with data presented alongside the photo (Figure 1). Photographs are sorted in chronological order within treatments, so that the user can scroll through photographs in time series to observe changes within the grass population. Dryad outputs photographs to different onscreen formats ranging in complexity. Similar to the single photograph output is a transect view of a site, where photographs from five transects are presented for a single recording date (Figure 2). The time series view presents photographs from a single transect, where photographs from every recording date are presented (Figure 3).

Figure 1. Simple single photograph output with quadrat data describing the location within a grazing trial and photograph name and directory path.

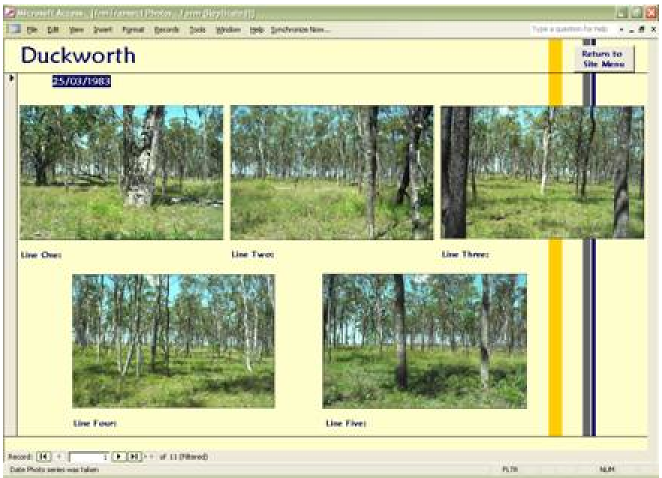

Figure 2. Simple photo series output from the Dryad Database showing photographs of five transect lines at a single monitoring site taken on the same date.

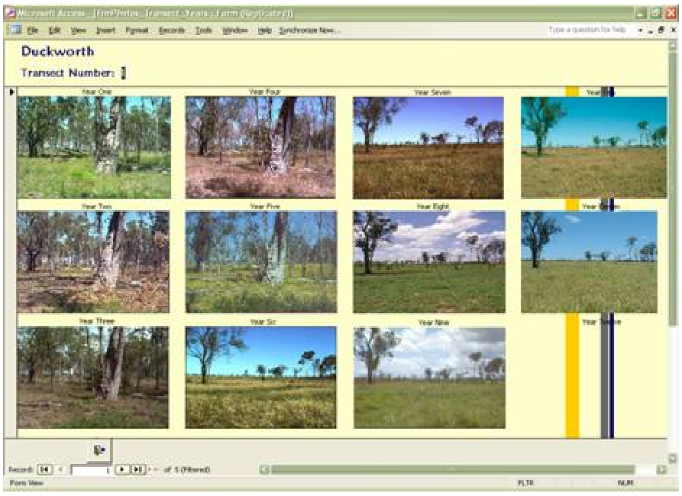

Figure 3. Complex photo series output from the Dryad Database showing photographs of a single monitoring transect taken at 11 recording dates, from 1987 to 2005.

Image outputs are not restricted to onscreen views of photographs. Dryad also outputs to a field sheet report, which includes data such as landholder details, last recording date, site comments and the image is a “mud map” of the site location. Including the photograph, directory path and file name as an output ensures that retrieval of images files is easy and efficient. Alternatively, the image directory path can be included as a hyperlink, taking users directly to the image file being viewed.

CONCLUSION

Photographic records of vegetation dynamics have been used to reinforce and highlight population changes recorded by various monitoring systems, such as permanent transects and quadrats. The development of a database to organise, store and interpret photographic files is an essential part of documenting the changes in vegetation. MSAccess is readily available and provides a flexible means of accessing and utilising photographs and associated data, enhancing the value of digital photographs in all aspects of research. This system is relevant to researchers, landholders and managers to compliment existing monitoring systems in ecological rangeland studies.

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