Smartphone apps for environmental weed management

Steve Taylor[1] and Jenny Conolly[2]
[1] ACT Parks and Conservation Service, 500 Cotter Road, Weston Creek, ACT 2611, Australia
[2] Parks and City Services, Macarthur House, 12 Wattle Street, Lyneham, ACT 2602, Australia
(parkranger818@gmail.com)

Summary The ACT Parks and Conservation Service (ACTPCS) undertook a trial of apps and smartphones to assist with weed management. The apps were used for mapping, weed identification and recording the control of weed infestations.

The trial has been a success with an increased level of mapping by participating park rangers due to the ease of map generation. The quality of data has increased and there have been significant time savings in transferring data.

Keywords Apps, new technology, mapping.

INTRODUCTION

Weed mapping often involves the use of specialised mapping software run on laptops or tablets (Motion 2014). Rangers do not always carry laptops or tablets but many have smartphones. This led to the idea of trialling the latest smartphones apps for weed mapping. An app is a computer program that runs a specific task.

Smartphone apps are relatively easy to use, so it was likely that mapping and reporting apps would improve record keeping. Any tool that makes mapping easier is likely to help with early reporting of highly invasive weeds. Early reporting is essential so that containment work can be undertaken as soon as possible (WSSA 2014).

The other main aim of the app trial was to test emailing maps and records from the field. If successful, there would be no need for Rangers to return early to their depots to download files or transcribe paper records to computer databases.

There are important features that an app must have to be suitable for use by rangers and other field staff. The app must be able to work off-line. Off-line means that the app can function when there is no 3G mobile phone signal or Wi-Fi connection. Rangers often work where there are no such data signals.

Rangers use either Android™ or Apple™ smartphones so it is important that a mapping app can work on either of these devices. The data produced by the app also needs to be compatible with corporate Windows™ based programs.

MATERIALS AND METHODS

There are many different mapping apps available on Google Play™ and the Apple Store™ (Google Play 2014a).

Most mapping apps do not have an off-line function. Some cache maps but they are not practical as only sections of maps can be pre-cached. A practical off-line system allows the maps and shapefiles to be stored on the device. This is because rangers need to be able to refer to all their maps and follow-up weed control areas, while in the field.

The Memory-Map™ app formed the basis of the trial as it has a fully off-line mapping system (Memory-Map 2014).

The Memory-Map app is based around the 1:25,000 topographic maps that can be zoomed in to 1:6000. These maps are downloaded to the mobile device. The maps are paid for separately to the app. The app is free on Android and there is a small charge for the Apple version.

Overlays or gpx shapefiles (GPS exchange files) can be created as routes (drawn polygons, Figure 1), marks (single points, Figure 2), or tracks (polygon created on the move, Figure 2). The gpx files can be shared by Gmail™, email or uploaded to a cloud service like Google Drive™ or Dropbox™ (Figures 3 and 4). Screen shots of maps and photos can also be attached to emails.

If there is no data signal then emails stay in the outbox till the Ranger drives over a hill or back into town. One Ranger depot has established a Wi-Fi hot spot as an alternative to poor mobile data signals during the day. Gpx files are very small so they send readily even with a patchy mobile data network.

Memory-Map app gpx files allow for attributes to be attached such as weed species, density and the type of control work undertaken (Figure 3). The gpx files are converted to ESRI™ shapefiles using the Windows DNR GPS™ program and then uploaded to the Windows ArcGIS ACT Weeds Atlas (Figure 5). ESRI shapefiles can also be converted to gpx files and loaded to the off-line Memory-Map maps. This was successfully done during the trial for rare and uncommon native plant data.

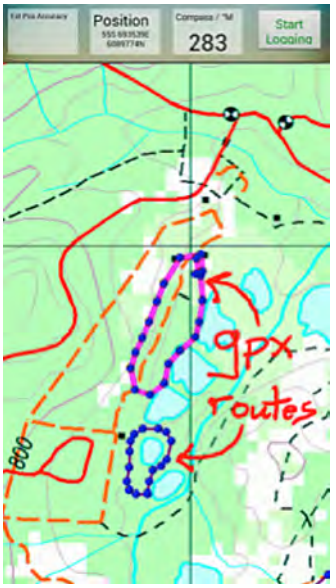

Figure 1. Memory-Map gpx routes.

Figure 2. Memory-Map gpx track and marks.

Figure 3. Gpx route attributes.

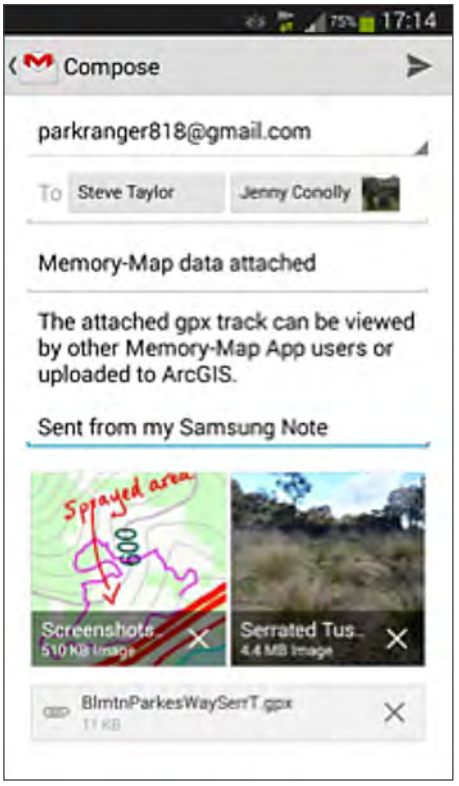

Figure 4. Sharing data.

Figure 5. Uploaded gpx files in the ArcGIS.

Memory-Map app gpx files were shared during the trial among staff and contractors running Memory-Map. This reduced the need for face-to-face meetings on sites.

There is an advantage in finding an off the shelf app that meets your requirements. This is because the app developer has a vested interest in fixing 'bugs' and ensuring the app works on the latest smartphone devices on the market.

Smartphones and phablets Initially standard-sized smartphones were used to test the apps. The screens were clearly too small to easily view maps. The trial settled on the larger screen-sized 'phablet' smartphone (Figure 6).

In the early stages of the trial the only suitable large screen smartphone available was the Samsung Note™. It had a sufficiently large screen to make mapping practical, yet was still small enough, in a shock-proof Otterbox™, to fit in a Ranger's cargo pocket.

The Note phablets also come with a built in stylus for annotating screen shots of maps and is useful for staff with large fingers. The phablets have significantly longer battery capacity, which is an advantage with frequent GPS usage (Table 1).

Other weed management apps The University of Queensland has produced an off-line Lucid key Android app called Environmental Weeds of Australia (EWA) ™ (Google Play 2014b). Rangers who used the key, during the trial were very impressed with the ease of use and the species information.

The Android e-Droid Cell Pro™ app (Google Play 2014c), another off-the shelf app, allows .xlt Excel™ files with drop down lists to be used for field data entry (Figures 7 and 8). The data is sent via the Gmail network and uploaded to a Windows Access database.

There was significant time saving during the trial using the drop down list forms on mobile devices. It removed the double recording that is a standard with a lot of fieldwork. The double recording occurs because a recording sheet is filled out in the field. Then someone has to type the data from the form into a spreadsheet or database back at a depot.

Figure 6. Note 3 phablet.

Figure 7. e-Droid Cell Pro Spreadsheet.

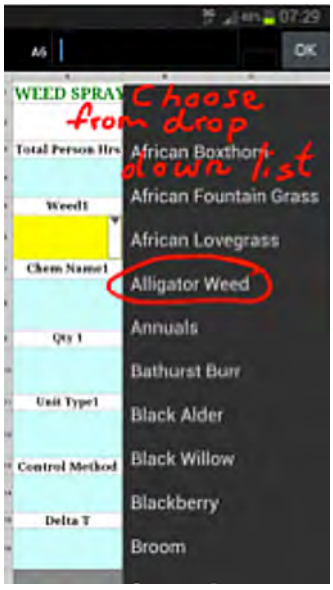

Figure 8. e-Droid Cell Pro drop down lists

Table 1. Smartphone, phablet trial.

Device	Screen	GPS type	Battery
Standard smart –phones	102 mm (4") to 127 mm (5")	A-GPS, +/− GLONASS	1440 – 2600 mAh
Note 2 phablet	140 mm (5.5")	A-GPS and GLONASS	3100 mAh
Note 3 phablet	145 mm (5.7")	A-GPS and GLONASS	3200 mAh

RESULTS AND DISCUSSION

Trialling off-line smartphone apps for mapping, and recording control work have been a success. The reasons:

- Apps were found to be simple to use leading to increased reporting and mapping by Rangers.
- Off-line apps were found to be fully functional without a data signal (essential for rural or remote areas). This allowed field staff to create maps and record data and store it on the device.
- The apps automatically emailed files when a mobile data 3G network or Wi-Fi signal was detected.
- The data produced was easily uploaded to the corporate Windows based ArcGIS and Access database.
- The Rangers always carried their smartphone or phablet, so incidental records of new weed infestations increased.

Cost effectiveness was also a bonus, as the smartphones and phablets used for mapping were also used as cameras, and for day-to-day email, communication and GPS tasks.

The large screen phablet style smartphone was found to be superior for mapping compared to the standard-sized smartphone, because you can see more of the mapped area.

The increased battery size in the phablets, made them more practical for remote area use.

The technology in this field is changing rapidly, so it is impossible to keep up with all the latest improvements.

The rapid changes are not an issue so long as the apps can work effectively off-line and produce data that are easily uploaded into your existing corporate desktop computer programs.

ACKNOWLEDGMENTS

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