Offline Maps for Wildland Fire and Natural Resource Management: Custom GPS Enabled Maps on a Mobile Device

David Godwin

INTRODUCTION

Improvements in smartphone and tablet device hardware and software have made it relatively easy for wildland fire and natural resource professionals to use digital maps in the field. Digital map uses include a variety of resource management tasks: custom prescribed fire maps, boundary line and timber cruising, damage surveys, wildlife inventories, and more. Unfortunately, since many of the most common mobile device mapping applications (apps) require constant data connectivity to stream maps, such applications often have little utility for wildland fire and natural resource management operations due to remote operating locations. This fact sheet provides instructions for exporting GPS enabled custom self-contained maps into a GeoPDF format that can later be georeferenced in the field using a mobile app without requiring cellular or data connections (3G/4G or wifi).

Software required for these instructions:
- **ESRI ArcMap 10.01 (desktop GIS application)**
  http://www.esri.com/software/arcgis
- **Avenza PDF Maps (free mobile mapping app)**
  http://www.avenza.com/pdf-maps
- **DropBox (free mobile file storage/sharing app)**
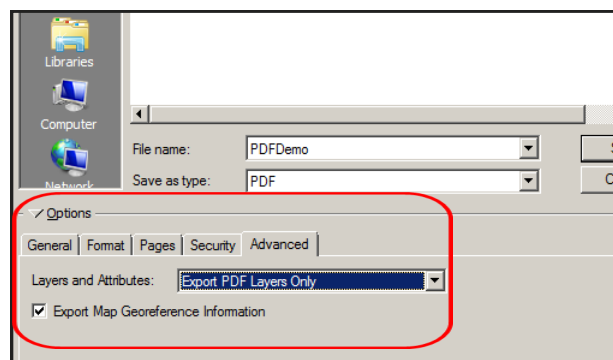 http://www.dropbox.com

INSTRUCTIONS

Figure 1. Avenza PDF Maps is a free mobile application for the Apple iOS and Google Android mobile device operating systems that enables users to plot their position on a preloaded custom map in the field without needing a data connection.

Note: The screen captures included in this fact sheet were taken on a Windows 7 machine and an Apple iOS 7 mobile device. Changes in software and operating systems may require modifications of these directions.

Step 1: Build a custom map in ESRI ArcGIS. Assemble the layers and zoom to the desired area that should be visible within the custom map.
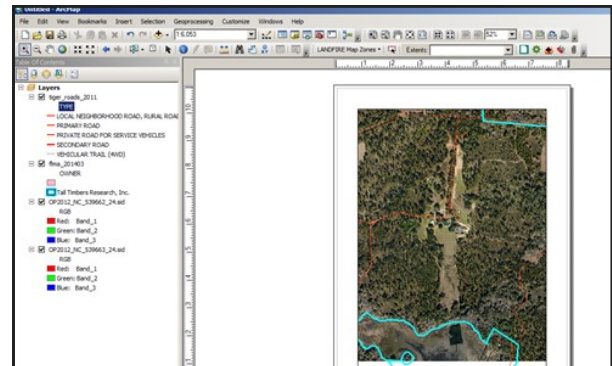
Step 2: Within ArcGIS, go to the File menu and select *Export Map*. Under *File Type* select *PDF*. Within the *Options* pane, select the *Advanced* tab. Under the *Layers and Attributes* dropdown menu select *Export PDF Layers Only*. Name the file and note the save location. Note: maps containing layers that have differing geographic coordinate systems may not ex-

port into GeoPDF files properly. If .PDF maps do not have spatial attributes once loaded in Avenza PDF Maps, this may be because of problems with the geographic coordinate systems in ArcGIS.

Step 3: Once the .PDF map has been saved, there are several methods for getting the map into Avenza PDF Maps: (1) connecting the mobile device to the computer and loading the .PDF map file directly using the iOS or Android file management systems; (2) emailing the .PDF map and opening the email as an attachment on the mobile device; (3) copying the .PDF map into DropBox and accessing the DropBox file from within the Avenza PDF Maps application on the mobile device; (4) copying the .PDF map to the Drop-Box *Public* folder and sharing the file download link using a direct URL or custom QR code. The last option using the QR code may be useful for sharing the link on handouts or incident maps.

Steps 4 - 6 provide details on how to share the .PDF map using a QR code generator and how to load the .PDF map using a QR code reader and Avenza PDF Maps.

Step 4: Navigate to the DropBox folder on the computer and copy the .PDF map file into the DropBox Public folder. Once copied, right click on the .pdf map file and select *Copy public link*.
Paste the copied link into a QR code generator (such
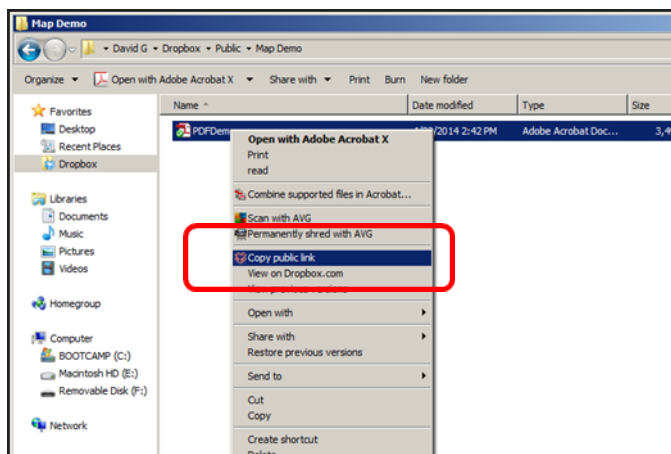
as http://www.qrstuff.com) to generate a QR code graphic that can be pasted into a fire planning map or poster.

Step 5: If the .PDF map was emailed directly as an attachment jump to Step 7. On the mobile device, open a QR code reader application and scan the QR code generated in the previous step. Copy the decoded URL so that it can later be pasted into Avenza PDF Maps.
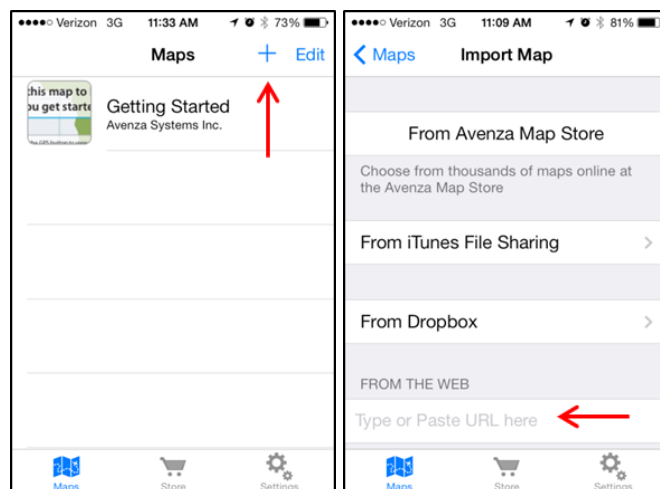
Step 6: Open the Avenza PDF Maps application on the mobile device and click the "+" icon in the upper right corner of the screen. This opens up the *Import Map* window. If a QR code reader was used to copy the decoded URL, paste the copied link into the *From the Web* field. Once pasted, the map will begin loading and should be listed in the *Maps* screen.
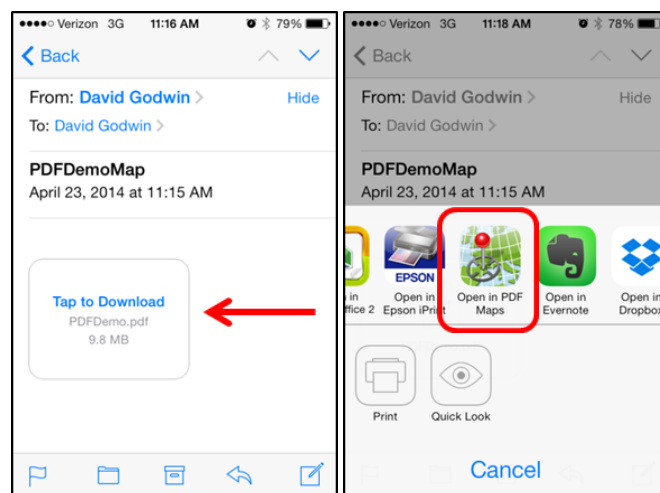

Step 7: If the user emailed the .PDF map directly, open the email on the mobile device and click to download the map. Once downloaded within the email application, click and hold on the map icon to select an application to open the map. Select *Open in PDF Maps*. The Avenza PDF Maps application should automatically open and begin loading the map. After the map is loaded, it should show up on the *Maps* screen. Click on the map title in the *Maps* screen to load the map. **As soon as the map is loaded in Avenza PDF Maps, data connectivity is no longer needed for Steps 8-11.**

Step 8: Once the map is loaded into Avenza PDF Maps, clicking on the arrow in the lower left corner of the screen will plot the current mobile device GPS based position on the map (indicated as a blue circle).

Step 9: Clicking on the *Tools* wrench icon in the lower right corner will open up a list of options that allows the user to record tracks, find places and coordinates, measure distance/area, and record plot photos.
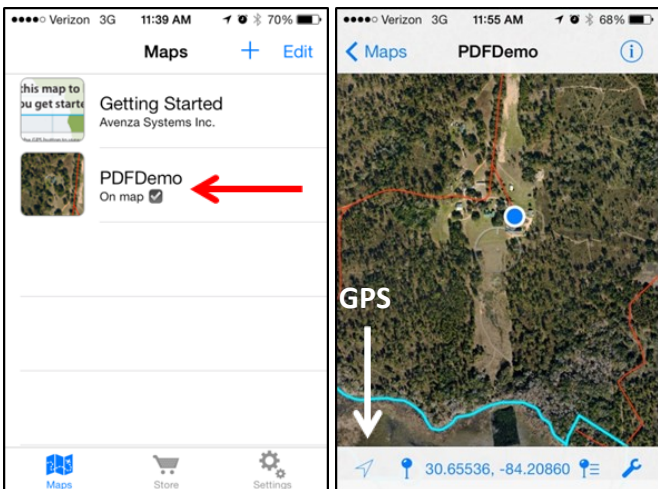

Step 10: Clicking on the *Record GPS Tracks* feature on the *Tools* menu allows the mobile device to record a GPS track of moving positions (visible as the orange line in the upper right images). While recording a *Track* the mobile device user is still able to capture and record *Placemarks* using the following instructions.
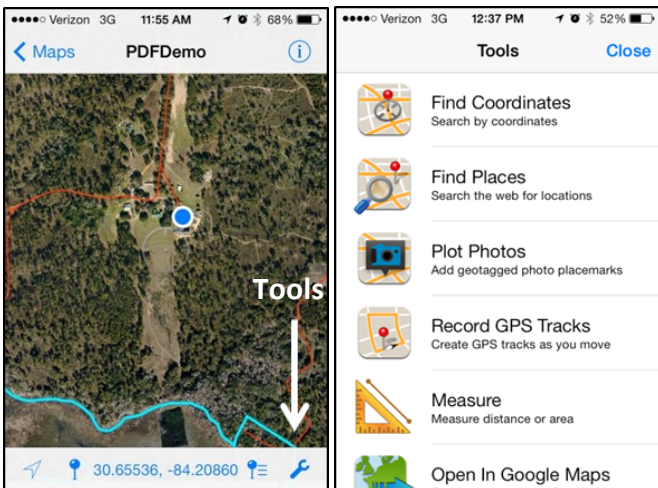

Step 11: Clicking on the *Placemark* button to the right of the arrow button will allow the user to save a *Placemark* (GPS point) at the current location. *Placemarks* can have custom names, icons, descriptions, and can link to a photograph.

Step 12: Once the mobile device is back within a connected cellular (3G / 4G) or wifi data network, *Tracks*, *Lines*, *Placemarks* and *Placemark* photos can be exported by clicking on the *Map Features* icon to the left of the *Tools* wrench icon. On the *Map Features* window, click *Export* to determine the export
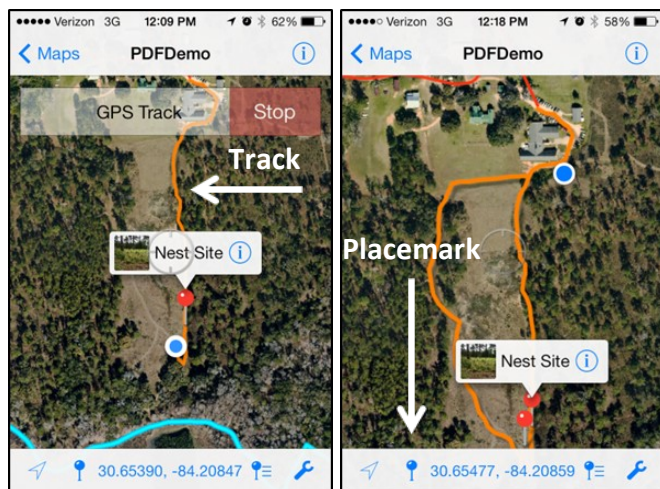
options, file type (.KML, .GPX, .CSV), and export method (iTunes, email, DropBox).
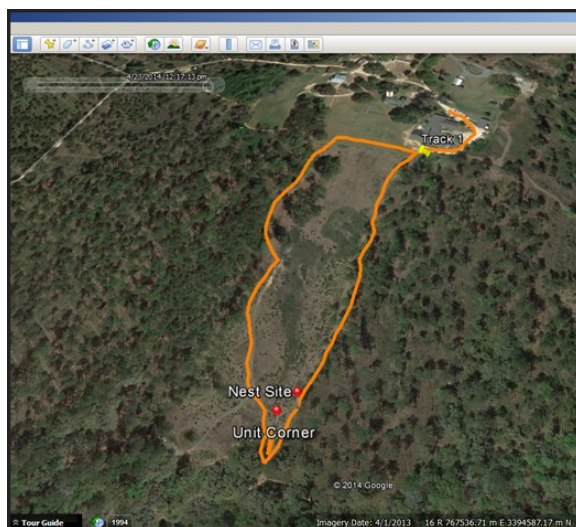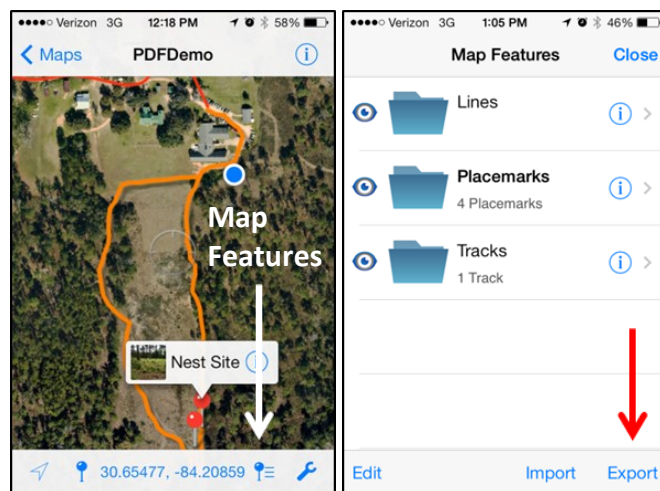
Step 13: (Optional) Emailing the exported Avenza PDF Maps files into a .KML format allows the user to view and archive the field data recorded on the mobile device in Google Earth on a desktop computer. To open the *Track*, *Line*, and *Placemark* files on a desktop computer with Google Earth installed, simp-

ly double-click the .KML files after downloading the attachment. If Google Earth is the default application associated with .KML files, Google Earth will launch automatically and load the data exported from Avenza PDF Maps.

Additionally, emailing the exported Avenza PDF Maps files using a .GPX format allows the user to share, edit, and incorporate the field data recorded on the mobile device into ArcGIS Online or ArcGIS 10.1 on a desktop computer. To convert your .GPX file to a feature class within ArcGIS, open *ArcToolbox*, then select *Conversion Tools*, then select *From GPS*, and finally select *GPX to Features*.

APPLICATION DESCRIPTIONS

The steps described previously utilize three key commercial software programs: ArcGIS 10.1 from ESRI Inc., PDF Maps from Avenza Systems Inc., and DropBox from DropBox, Inc. ArcGIS 10.1 (http://www.esri.com/software/arcgis/arcgis10) is a commercially available geographic information system (GIS) software application commonly used in government, education, and industry mapping and analysis programs. Avenza PDF Maps (http://www.avenza.com/pdf-maps) is a free mobile application available in the Apple iOS App Store and the Google Android Market Place. DropBox is a free desktop and cloud-based file management and sharing program available online (https://www.dropbox.com/).

Mention of these products does not imply official endorsement of such products or companies.

ADDITIONAL RESOURCES

For more information about using ArcGIS and Avenza PDF Maps to develop standalone mobile maps that are fully functional without field data connections see the following links:

Avenza PDF Maps Frequently Asked Questions (for both iOS and Android versions)
http://www.avenza.com/pdf-maps/support

Avenza PDF Maps Used in Chips Fire Fighting Mobile Mapping (Video)
http://www.youtube.com/watch?v=rCfnjOoQ_l8

Exporting an ArcGIS Map for Use in the PDF Maps App (Video)
https://vimeo.com/79337719

NWCG Geospatial Subcommittee
https://www.nwcg.gov/committees/geospatial-subcommittee