



Using GeoJot During Future Storm Events

A Standard Operating Procedure for NPS Resource Managers and READ Personnel

Natural Resource Report NPS/NCBN/NRR—2016/1123



ON THE COVER

Examples of photo using GeoJot+ on an iPhone.
Photograph courtesy of the National Park Service

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Overview

Hurricane Sandy

Hurricane (Superstorm) Sandy formed on October 22, 2012 in the southern Caribbean off Nicaragua, eventually making landfall in the New Jersey region of the east coast on October 29, 2012. The total estimated cost of damage caused by the storm was upwards of \$75 billion, making Sandy the second most expensive storm in U.S. history, topped only by Hurricane Katrina 2005 (\$108 billion).

NPS READ

Parks need to make the most efficient use of Resource Advisors (READs), temporary professional staff that are dispatched to assist in storm mitigation, and provide them with a clear set of guidelines to collect critical post-storm data. Properly documenting evidence of storm effects will go a long way towards managing natural resources and infrastructure for future events.

Documenting evidence of storm impacts (e.g., mapping locations of inland storm surge extents) requires specially trained field personnel with the ability to detect and interpret clues, along with the technical capability to operate handheld GPS-enabled mapping units and acquire ground photos with proper perspective. The Storm Data geospatial team at University of Rhode Island (URI) will draw upon the knowledge and experience gained with post-storm data collection along the Rhode Island coastline immediately following Hurricane Sandy, in addition to consulting with Park Resource Managers and GIS Specialists at Gateway National Recreation Area (GATE), Fire Island National Seashore (FIIS), and Assateague Island National Seashore (ASIS). The team will package these steps into a Standard Operating Procedure (SOP) document that can be deployed to NPS Resource Managers and READ personnel during future storm response events.

When a hurricane makes landfall in a National Park within the Northeast Region, NPS READ field crews are among the first to respond. During Hurricane Sandy for example, NPS scientists, engineers, and technicians were deployed along the eastern U.S. coast to reduce the impacts created by the event. Other federal agencies responded as well; the USGS created storm surge, streamflow, and water quality measurements related to hurricane floods, and provided other geospatial products of Hurricane movement and the storm aftermath. In the weeks and months following a major storm event, the NPS, in concert with our partners, will collect field photos and GPS position data to provide scientific assessments of the challenges wrought from a hurricane.

As a result of this and other data collection needs, the NPS has acquired an enterprise license agreement for the GeoJot+ Field Data Collection System so that NPS scientists can collect data in National Park Units. Due to the current adoption of this software, we propose that READ teams use the GeoJot+ system in response to natural disasters. This document has been written to overview the most recent version of GeoJot+ (October 2014) and the workflow that it entails.

Introduction to the GeoJot+ Field Data Collection System (GeoJot+ V 2.3.x and GeoJot+ Core V2.4.x)

The GeoJot+ System consists of the mobile application (GeoJot+), the desktop application (GeoJot+ Core) and an Administrator Dashboard. The GeoJot+ System is an annual subscription software package from [Geospatial Experts](http://www.geospatialexperts.com/GeoJot/) (<http://www.geospatialexperts.com/GeoJot/>) that allows its users to capture field data on GPS-enabled mobile devices and embed this information into spatially referenced photos (please see the appendix for NPS access directions). GPS coordinates and attribute data are stored and displayed directly within the header of the collected images, allowing for the collected photos to be easily converted into geospatial data. Currently, GeoJot+ is being used by U.S. government agencies, oil and gas companies, law enforcement personnel, natural resource scientists and engineering firms. The simplicity of the GeoJot+ software makes it a valuable tool for field data collection.

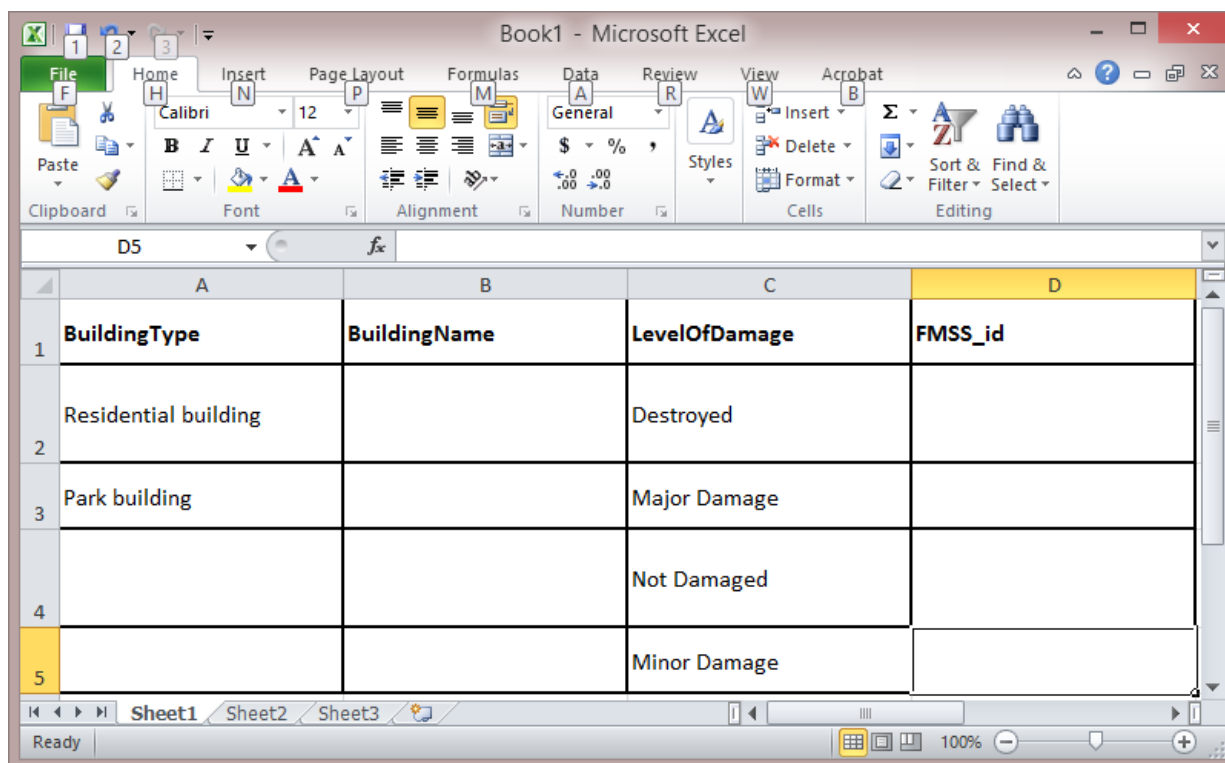
GeoJot+ Core is downloaded to your computer while the GeoJot+ mobile app can be downloaded to any modern-day smart phone or tablet running either iOS, Win Mobile, or Android. Be sure that the device has a GPS, along with a front plus rear-facing camera. If you are unsure if your device is supported you can contact GeoSpatial Experts.

The Administrator's Dashboard is an online resource that is used to manage, add and revoke application licenses for both the mobile and desktop versions of the software. Once data have been collected using the GeoJot+ mobile app, GeoJot+ Core can be used to create custom PDF reports, Word Docs, maps, text files, Google Earth products (.kml or .kmz) and ESRI data outputs (.shp, .gdb or .mdb). Core can also watermark, edit and resize images as well as rename them based on attributes collected in the field. If ArcGIS is installed on your computer, a new toolbar will be made available called "GeoJot+ Core", to be used with shapefiles created using the GeoJot+ system.

Using the GeoJot+ Software

Starting a Project and Creating a Data Form

Data are organized into projects based on the type of information being collected or the subject of the photos. Prior to field data collection, GeoJot+ Core can be used to create customized field data “forms” to streamline and organize the information being collected. The current software allows users to collect up to 44 attributes per photo. If a form has been created using Microsoft Excel, the spreadsheet can be imported into GeoJot+ Core and used in field data collection. Creating a form in Excel is an easy process. Figure 1 depicts the structure of an Excel table that can be imported into the GeoJot desktop software. For this spreadsheet structure to work, field names are listed at the top of the column and the dropdown options or pick lists are listed below the field names. Free text, such as “BuildingName” or “FMSS_id” are left blank as there isn’t a pick list for these. The form can then be copied over to the GeoJot+ App via an email account. The GeoJot+ App will then allow a user to type in free text for the form fields. In addition, there is a YouTube video that describes the process here (https://www.youtube.com/watch?v=3_eZ8eplTCg).



	A	B	C	D
1	BuildingType	BuildingName	LevelOfDamage	FMSS_id
2	Residential building		Destroyed	
3	Park building		Major Damage	
4			Not Damaged	
5			Minor Damage	

Figure 1. Example Excel Spreadsheet displaying the structure needed for a spreadsheet to be imported into GeoJot++. Note that the field names are at the top of the column and the dropdown options or pick lists are listed below the field names. Free text, such as BuildingName or FMSS_id is left blank as there isn’t a pick list for these.

Additionally, you can create a form using the GeoJot+ app on a phone or mobile devices in the field for short or more straight-forward forms. It is up to the form developer to select which process they choose to use. I prefer to create my forms on my cellphone but it is a user preference as there isn't a significant advantage to either approach. Once the form has been created, the file can be emailed or sent via the cloud to the field data collection teams for use on their mobile devices.

An example collection form, for assessing basic building damage can be downloaded as a zip file from here (http://www.edc.uri.edu/ftsc/GeoJot/Storm_Response.zip). GeoJot+ automatically stores the data form file with the .gseal extension. The GeoJot+ app will recognize this file once it has been downloaded and it will be added to the form list. Once a form is loaded, it can be used to collect field data.

Becoming Familiar with the GeoJot App for Collecting Data in the Field

In the field, users select the desired form and begin collecting data using the camera icon (Figure 2). When taking a picture you can use the **Lock on** function to lock in the coordinates of the object and then step back from the object to take the picture. This is beneficial for documenting large items or entire landscapes. The GPS position will remain “locked” for all future photos until the **Lock Off** button has been selected. The display settings icon can be used to change what will be displayed on the camera screen. Items that can be displayed include: latitude/longitude, altitude, direction of photo, GPS accuracy, pitch/roll, GPS Lock icon, camera flash icon and the form name. Once the photo has been taken, the form screen will automatically appear on your mobile device (Figure 3). Enter in the desired attribute fields and select **save** to save the picture and its corresponding data to the GeoJot+ camera roll and to lock in coordinates. It is important to note that you can also group photos together. Once the group of photos for an object has been taken, you can click on the form icon to fill out the form once for all of the grouped photos. Note that grouping photos is an advanced setting in the GeoJot + mobile app. If cloud storage has been established, using [Dropbox](#) for example, once a photo is saved it will automatically be uploaded to the desired folder.

Advanced section: When using multiple forms, it can be beneficial to rename photos based on the form name. This helps in the post-processing to process photos based on the specific form used. Basically, this is a good way to manage your spatial output since GeoJot+ core does not output multiple shapefiles for each form. To implement this, add the [form name] to each form in Field 1 of the form. Then rename the photo based on the text in Field 1. The new version of GeoJot+ for iOS already includes this feature and we understand that the Android version will include an option to rename based on [form name] under ‘Cloud’ in settings soon.

Flash Settings: Auto/On/Off



Change the lock Settings: On/Off

Figure 2. Screen depicting the GeoJot APP being used to collect a photo with coordinates and attributes. Note that the photo coordinates can be averaged to improve the photo coordinate. In this case, 40 GPS fixes were averaged to calculate a coordinate with an accuracy of ± 3 m.

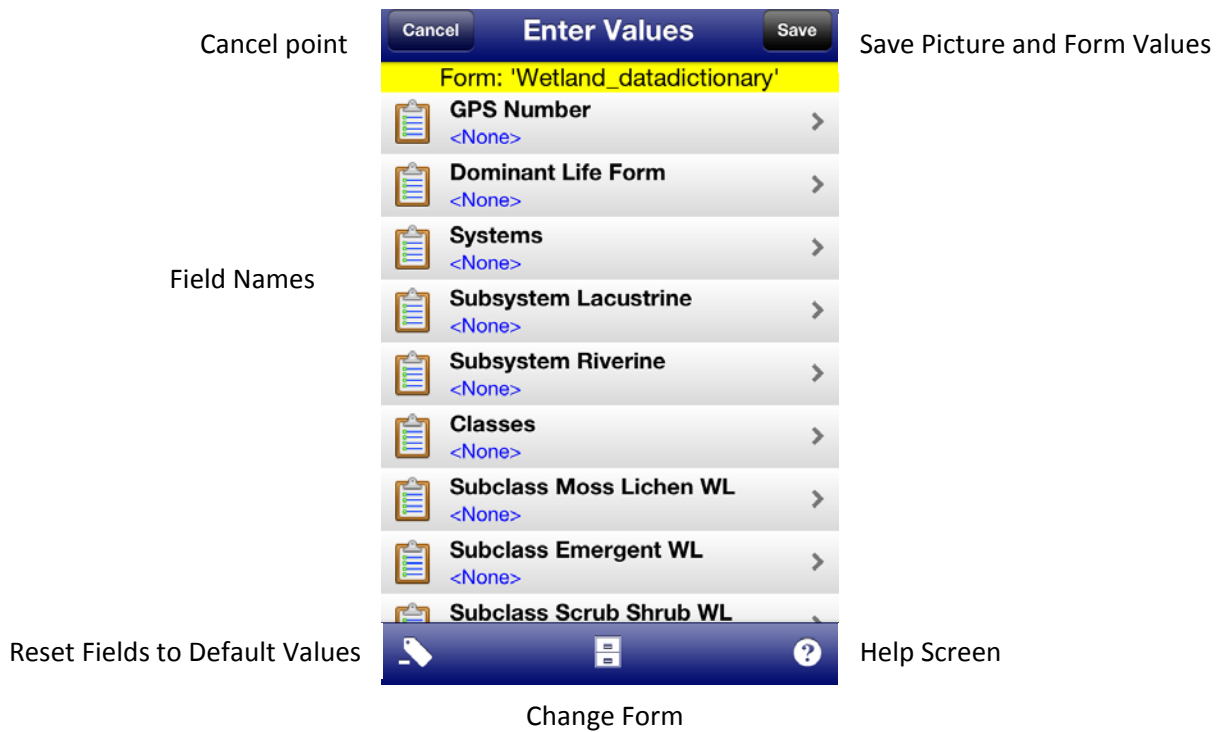


Figure 3. A form that is used to collect attribute information that is then imbedded inside the photo.

In-depth overview of GeoJot+ Screens

Below (Figure 4 - Figure 15) find screen captures of the GeoJot+ phone app running on a Google Nexus 5 Android phone. Note that there are slight differences between the Android version of the GeoJot+ app and the iPhone version, but the differences are self-explanatory.



Figure 4. About screen



Figure 5. Main screen with “Forms” button circled.



Figure 6. “Storm Response” form version 1.0.

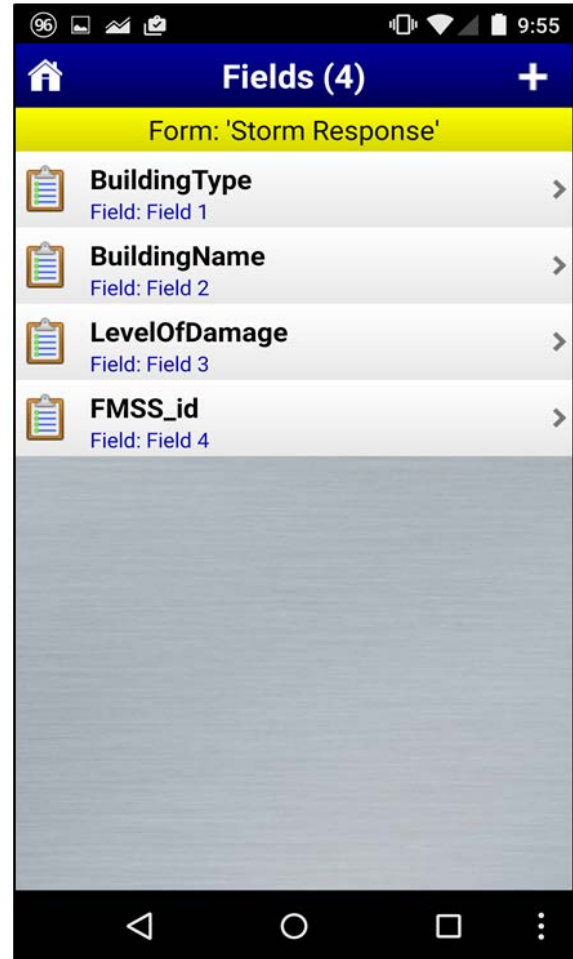


Figure 7. Form fields.

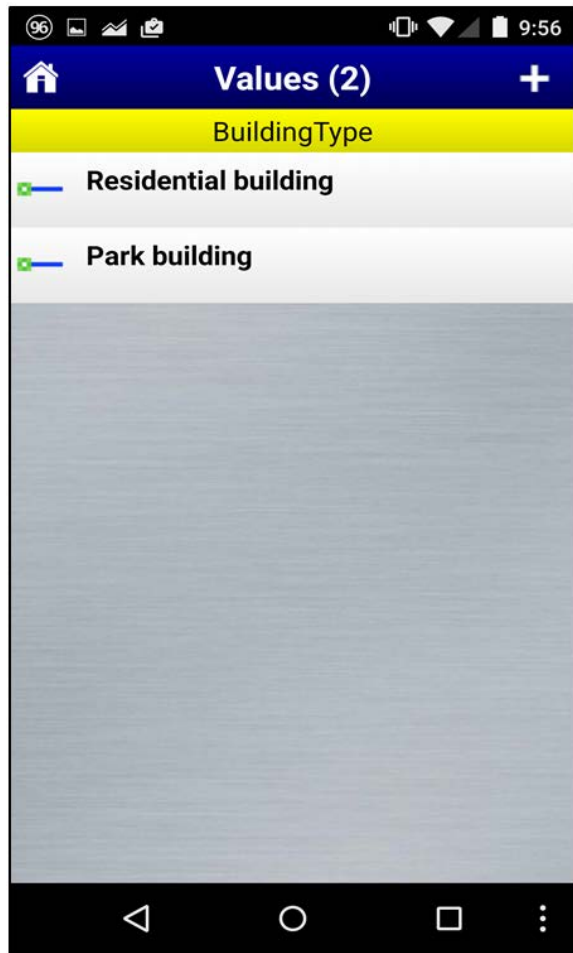


Figure 8. Building types.

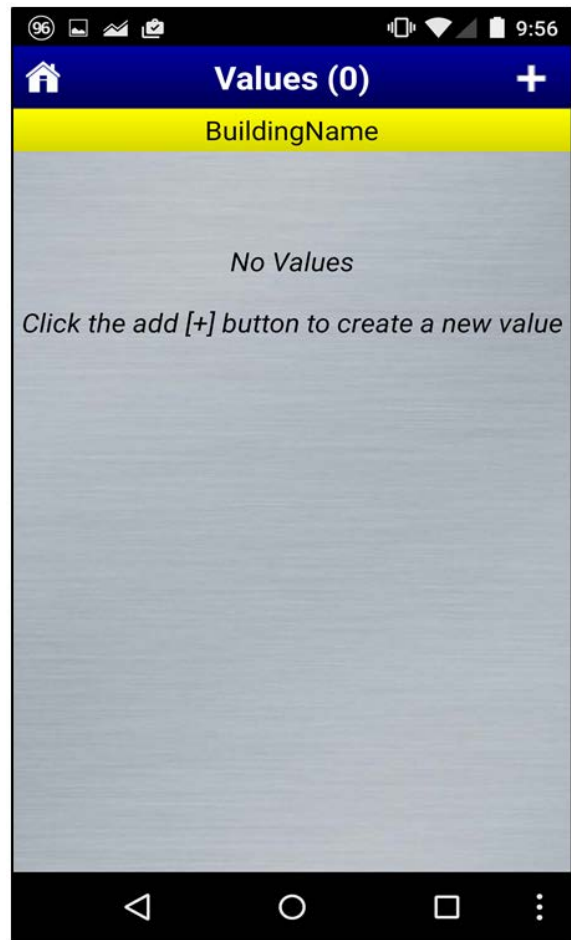


Figure 9. About Name.

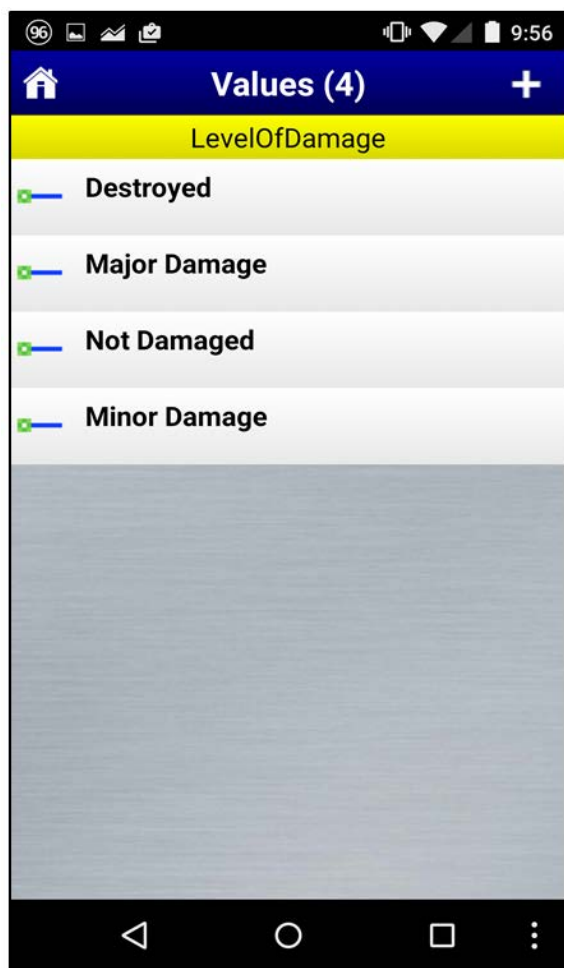


Figure 10. Level of damage.

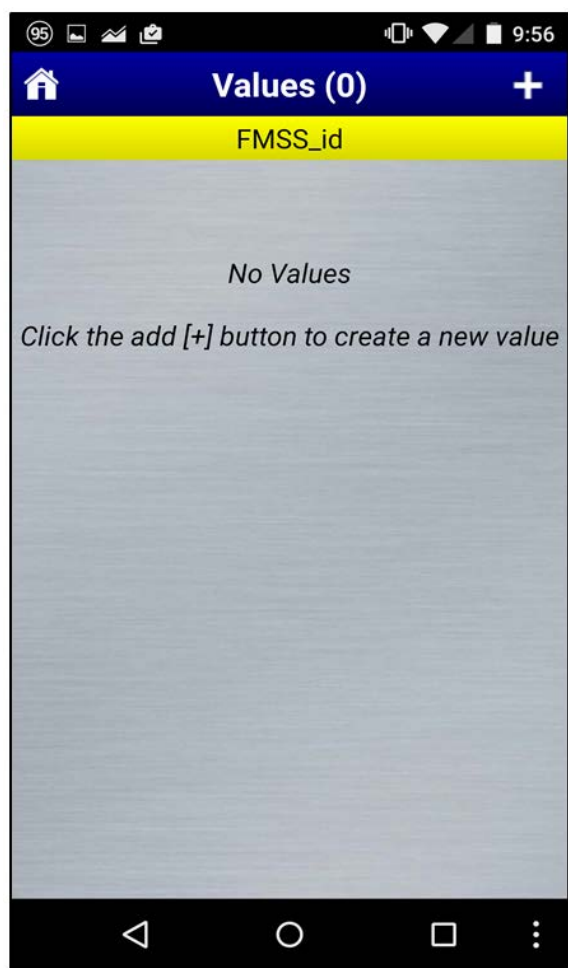


Figure 11. FMSS ID – Click the plus sign to begin editing.

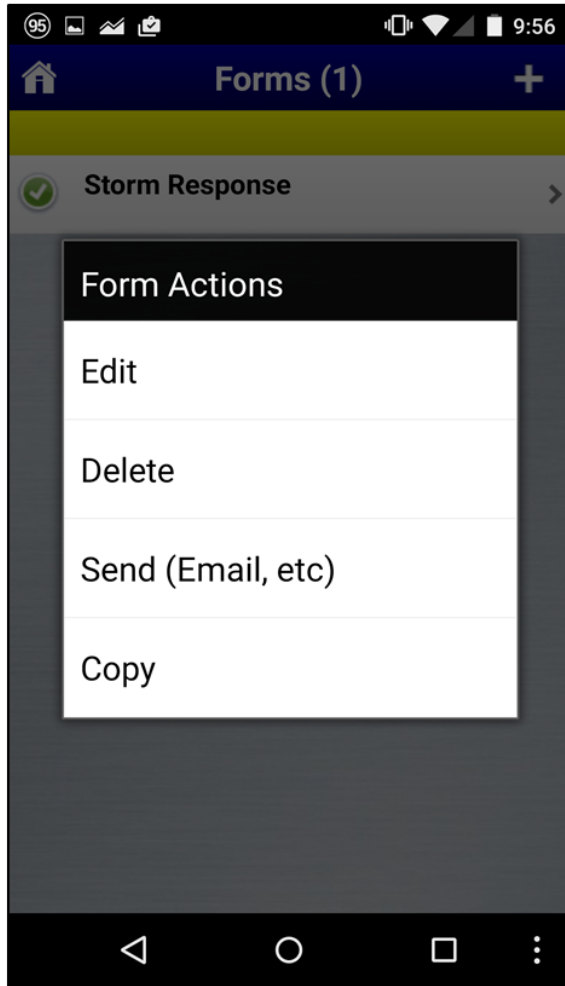


Figure 12. Clicking and holding down the form name (long clicking) allows for sharing or editing of the form.

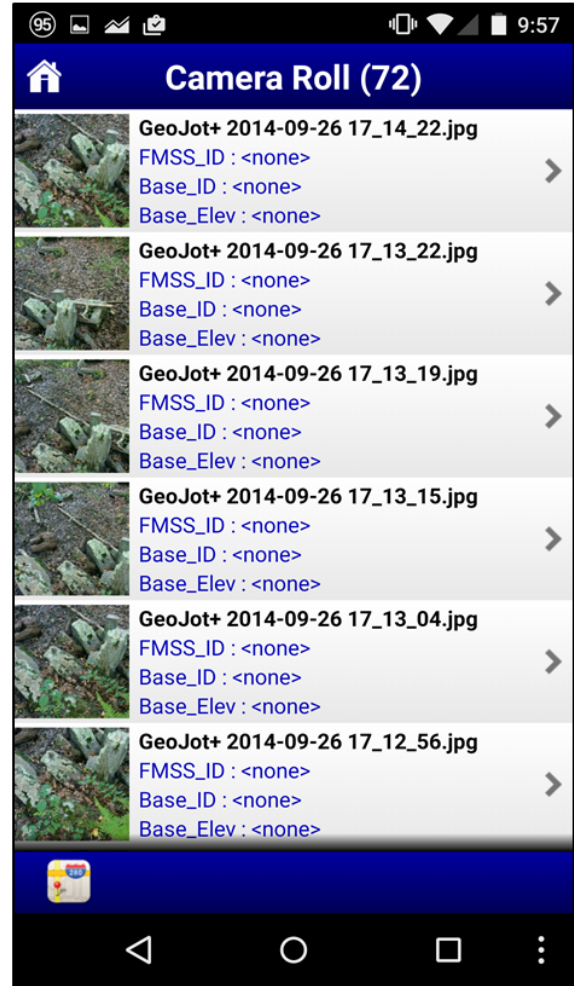


Figure 13. Example of the camera roll.



Figure 14. Setting screen.

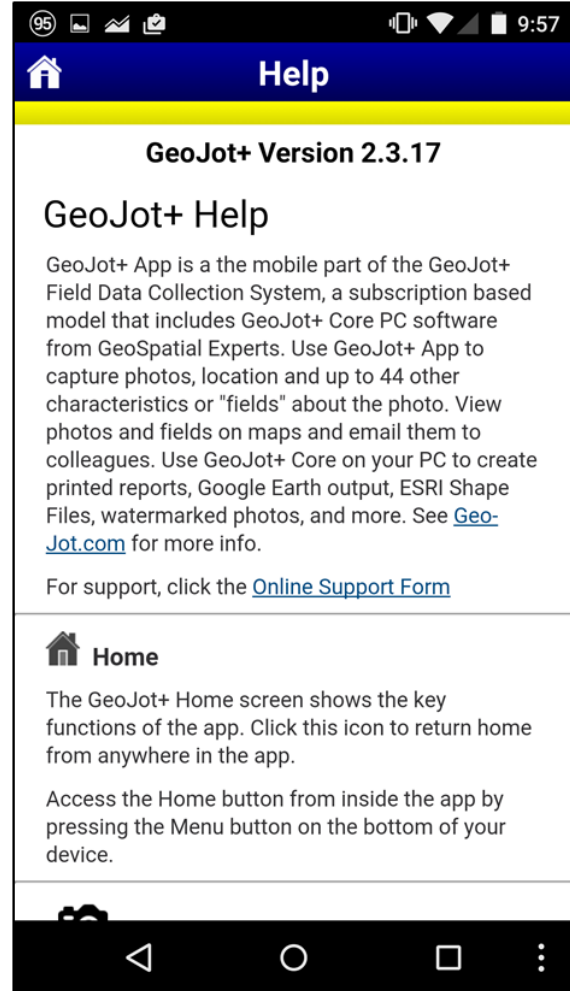


Figure 15. Help screen.

Post-Field Data Collection Processing

After all data have been collected, they can be processed using GeoJot+ Core. You can install the GeoJot+ Core software on your desktop computer by downloading it from this website (<http://www.geospatialexperts.com/GeoJot/>). The NPS license code (Linked in the Appendix) will allow you to run the trial version of the software as the NPS licensed version of the software, or you can run the trial version for 15 days.

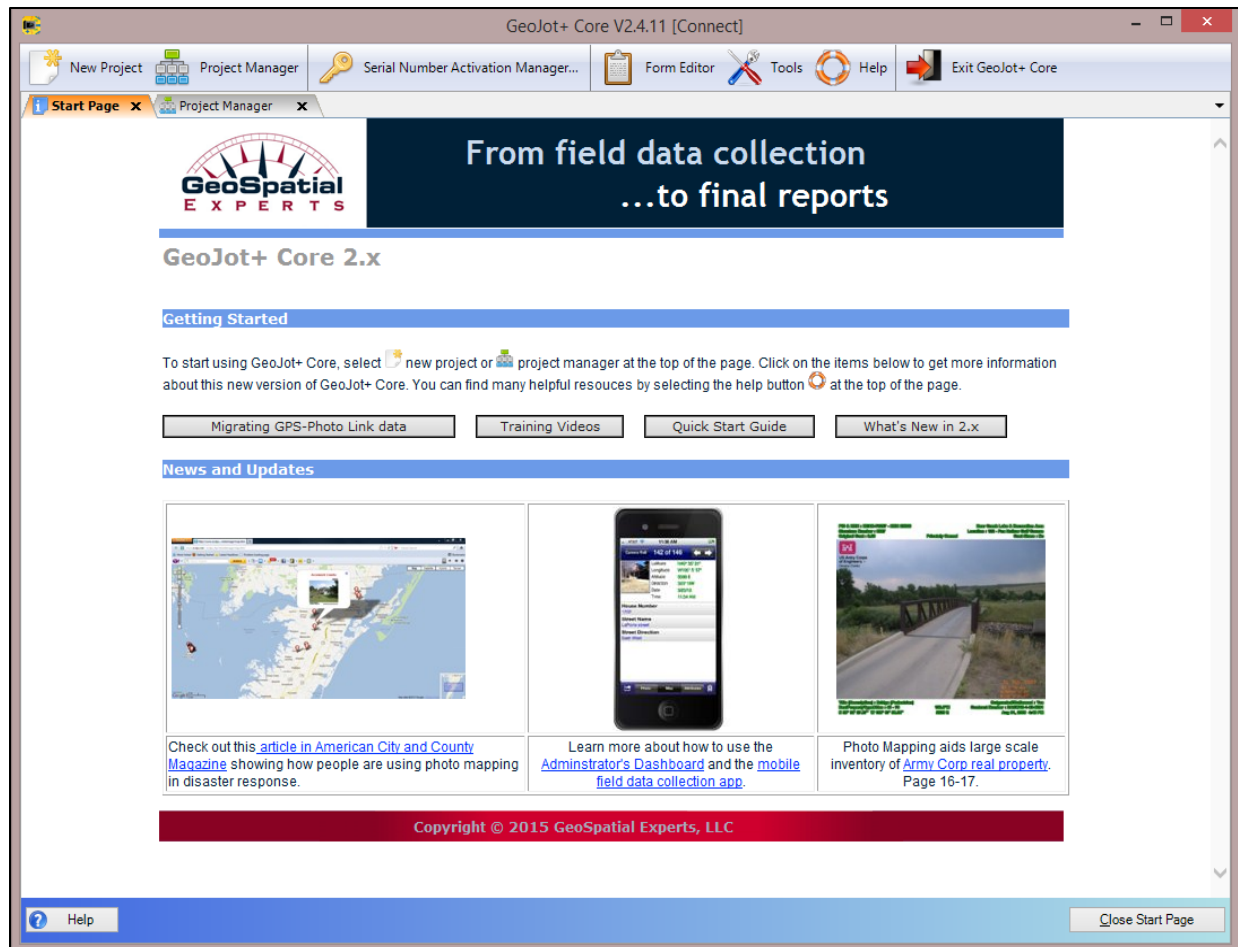


Figure 16. First screen that appears when you start the GeoJot Core software. Current version is 2.4.11.

To begin processing, navigate to the **Project Manager** tab (Figure 17) on the top ribbon, and select the desired project.

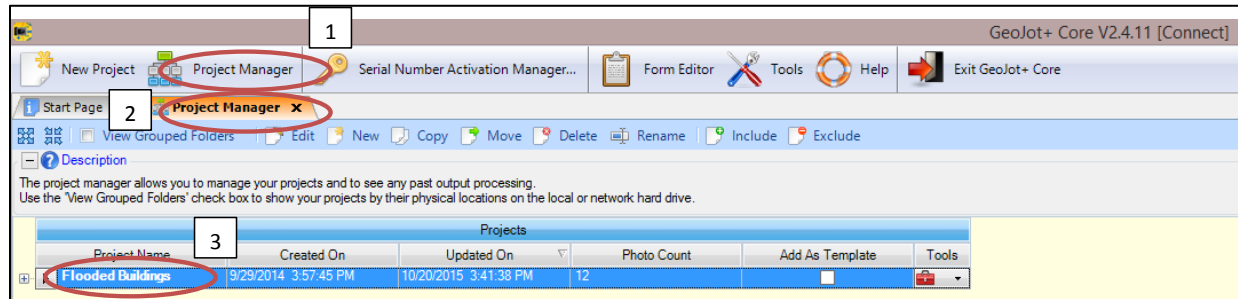


Figure 17. Screen Capture to highlight the location of the “Project Manager tab.”

Advanced approach: For each form, some users begin by setting up project templates in an effort to standardize the output. In a disaster response scenario, it may be helpful to deploy not only the forms but a project template as well. If desired, a user may use the ‘include’ function for bringing in a pre-defined project for use as a template. This isn’t currently a project template for disaster response.

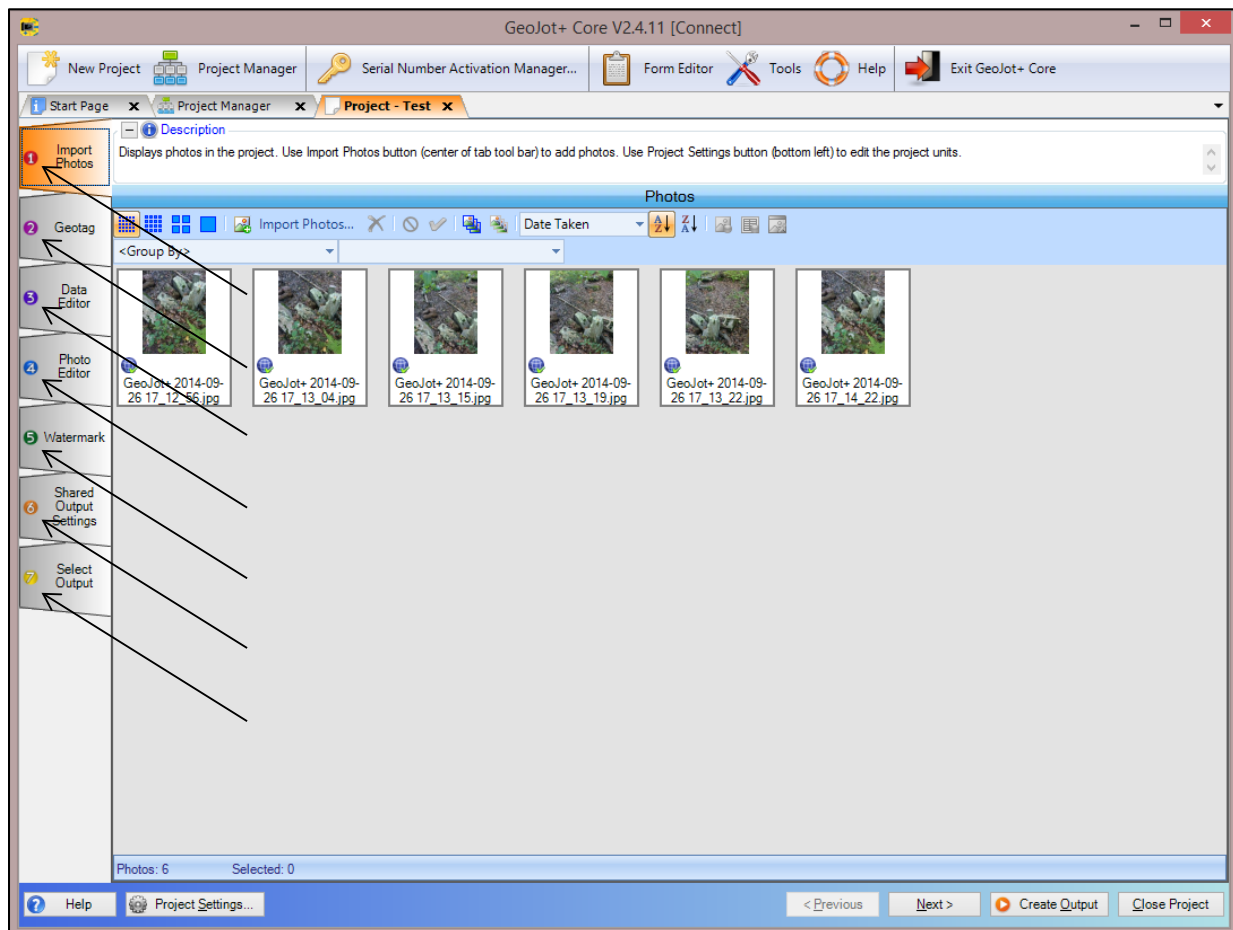


Figure 18. Screen capture depicted the tabs 1-7 within the GeoJot+ Core software (see arrows).

Importing Photos Using the Photos Tab (Tab 1)

This is where you can select which photos to add to the project. Additionally, this is where you can add photos taken with a digital camera or other devices to the project.

First, please see the documentation of your mobile device or camera to import photos onto your computer. Next, click on **Import Photos** (Figure 19) to import the photos from your computer or cellphone into the GeoJot + software. A new folder will be created within your GeoJot+ project folder called “imported photos”.

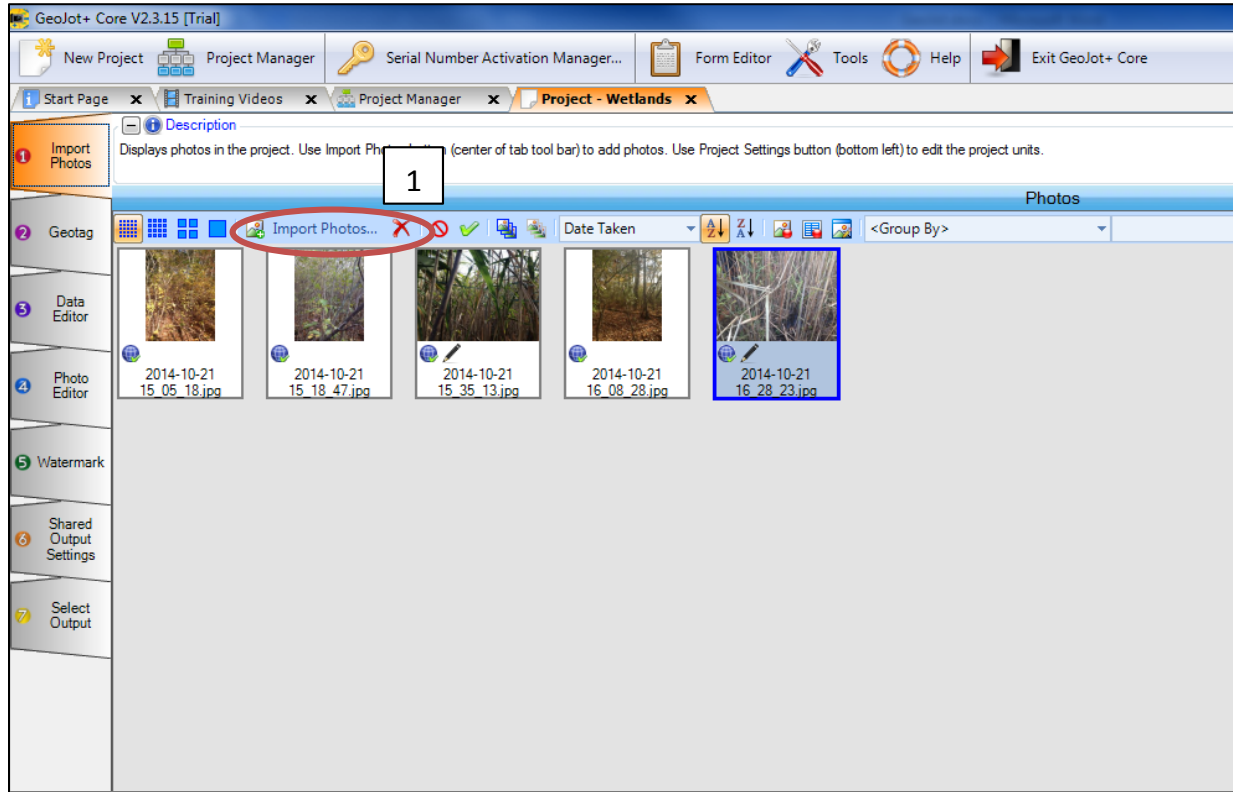


Figure 19. Click on (Import Photos [1] to import the photos from your computer or cellphone into the GeoJot + software). You can also drag and drop photos from the Windows file explorer.

Geotag Tab (Tab 2)

All photos taken using the GeoJot+ app are already geotagged. If additional photos were added, this shows the total number of photos in the project and number of photos that have been geo-tagged (figure 20).

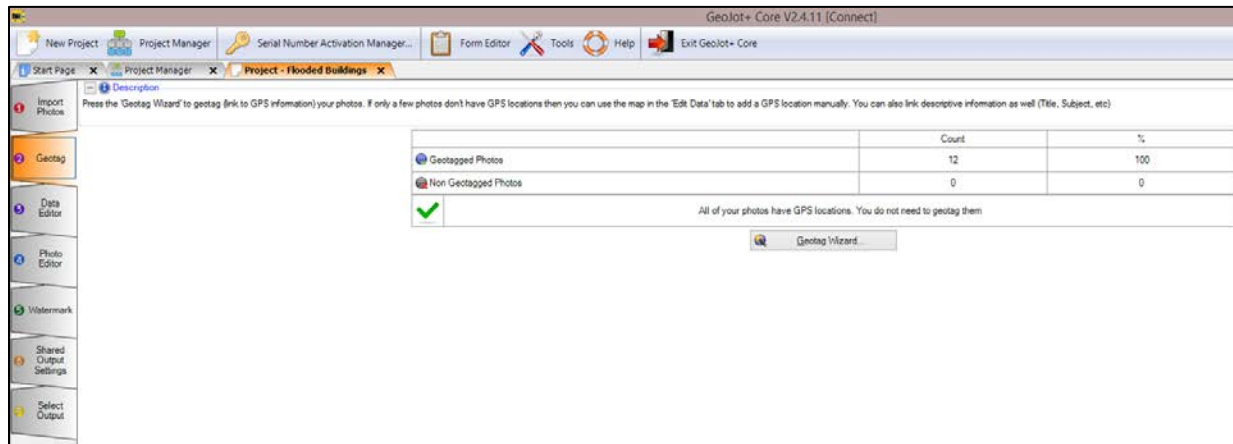


Figure 20. This shows the Geotag tab and the percentage of photos that have latitude, longitude coordinates.

Data Editor Tab (Tab 3)

This (Figure 21) is where you can edit the attribute information for the photos in your project. The screen contains three windows showing the photos in the project, the attributes of the selected photo and a map of the photo location(s). Only items shown in blue in the attribute window can be edited or changed. You can select all photos in the project and bulk-edit their attribute fields. Additionally, using these attribute fields, you can use the “sort by” drop box to sort your photos, use the “<Group By>” drop down box to group, and the filter drop down to filter based on attribute values. The map window allows you to visualize both the geo-location as well as the direction-of-look of each photo. If the location or direction of a photo is incorrect, you can change its location using the **Allow edit** button, and moving the photo icon to the desired location. This will automatically change the coordinates stored in the attribute table. When finished editing, click **save data**.

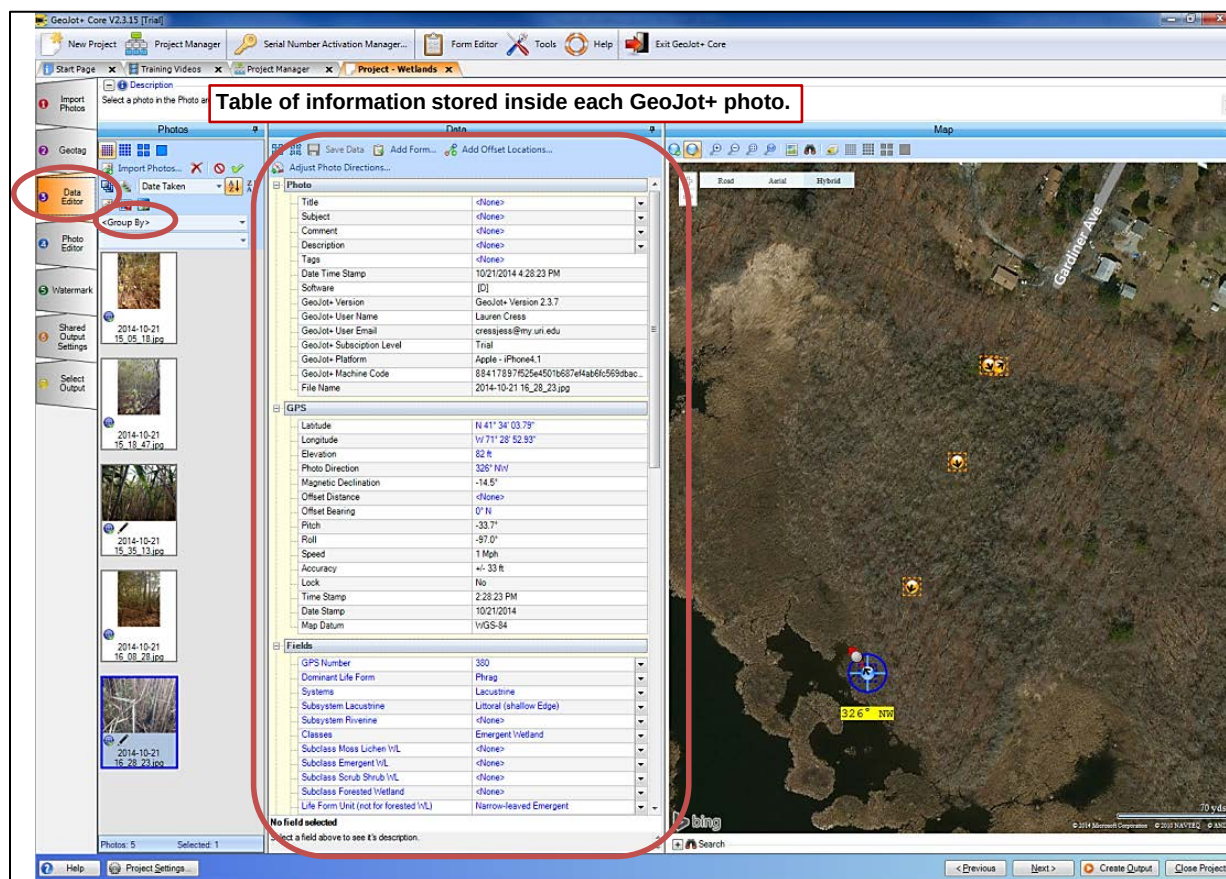


Figure 21. The “Data Editor” tab that displays the information that GeoJot and your mobile device store within each photo. You are allowed to add additional information to each photo here. The orange markers on the right aerial photo contain black arrows that indicate the direction the photos were taken.

Photo Editor Tab (Tab 4)

This (Figure 22) is where you can edit the visual properties of each photo. For example, each photo can be cropped, brightness and contrast can be adjusted and free hand text can be added. There is also a measure distance icon that once calibrated, can measure the length and width of items in the photo. This function only works if you already have the measurements of a referenced object in the photo. For example, if you are collecting data on telephone poles, and you know that the pole is 25 feet tall, you can draw a line on the photo, from the bottom of the pole to the top, and tell the system that the line is 25 feet tall. By doing this, you can measure other items in the photo based off of this calibration (this process works within the GeoJot+ Core software by scaling the number of pixels to the measurement line that you entered).

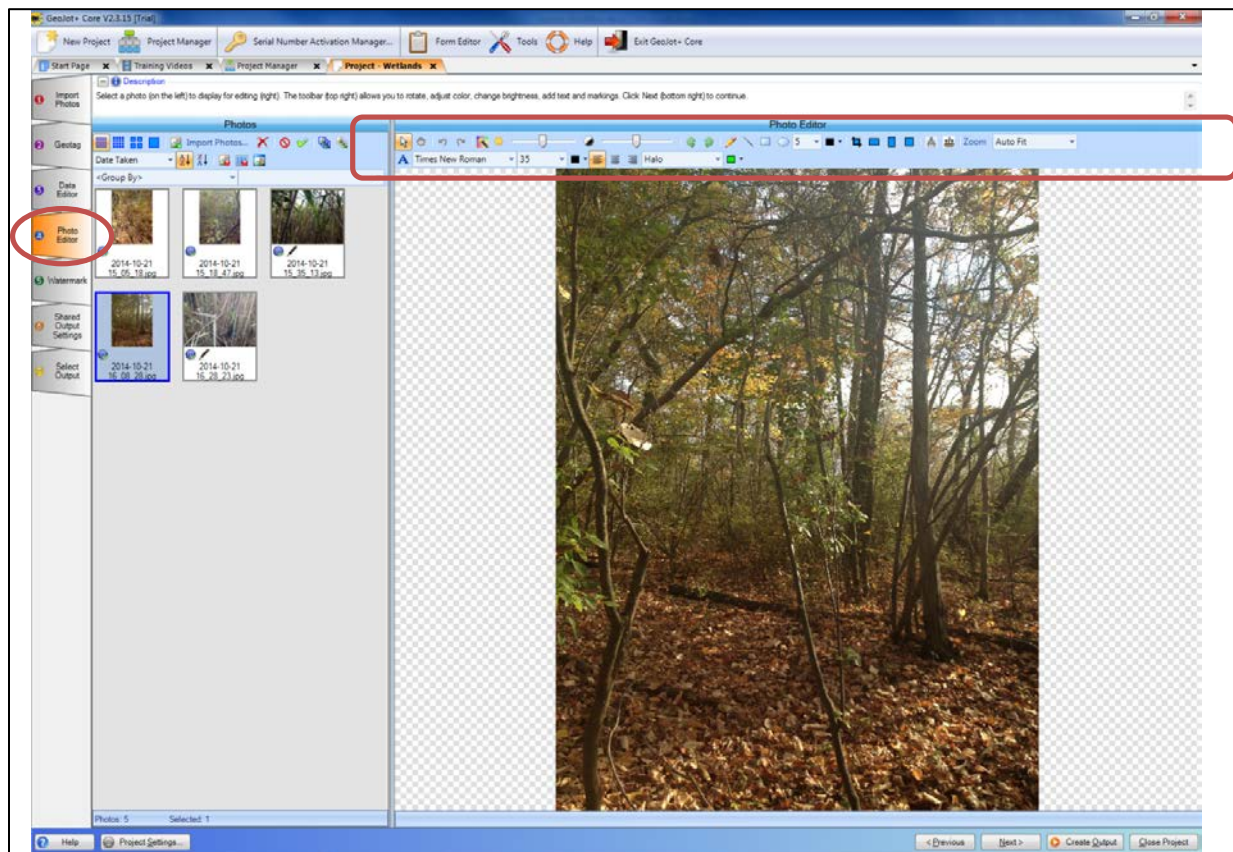


Figure 22. The “Photo Editor” tab that allows you to do basic photo editing such as color correction and cropping. Note that you can also add text to the photo using this interface. The photo editing toolbar in outlined with a rectangle in this figure.

Watermark Tab (Tab 5)

This tab (Figure 23) allows you to add watermarks from attribute fields to each photo. The watermarks can be displayed on the photo itself, or appear on the edges of the photo border. The watermark attribute tab allows you to select the location of each watermark item, and choose how it will be displayed on the photo. Additionally, the logo of a company or organization can be added by selecting the **Watermark Logo** tab.

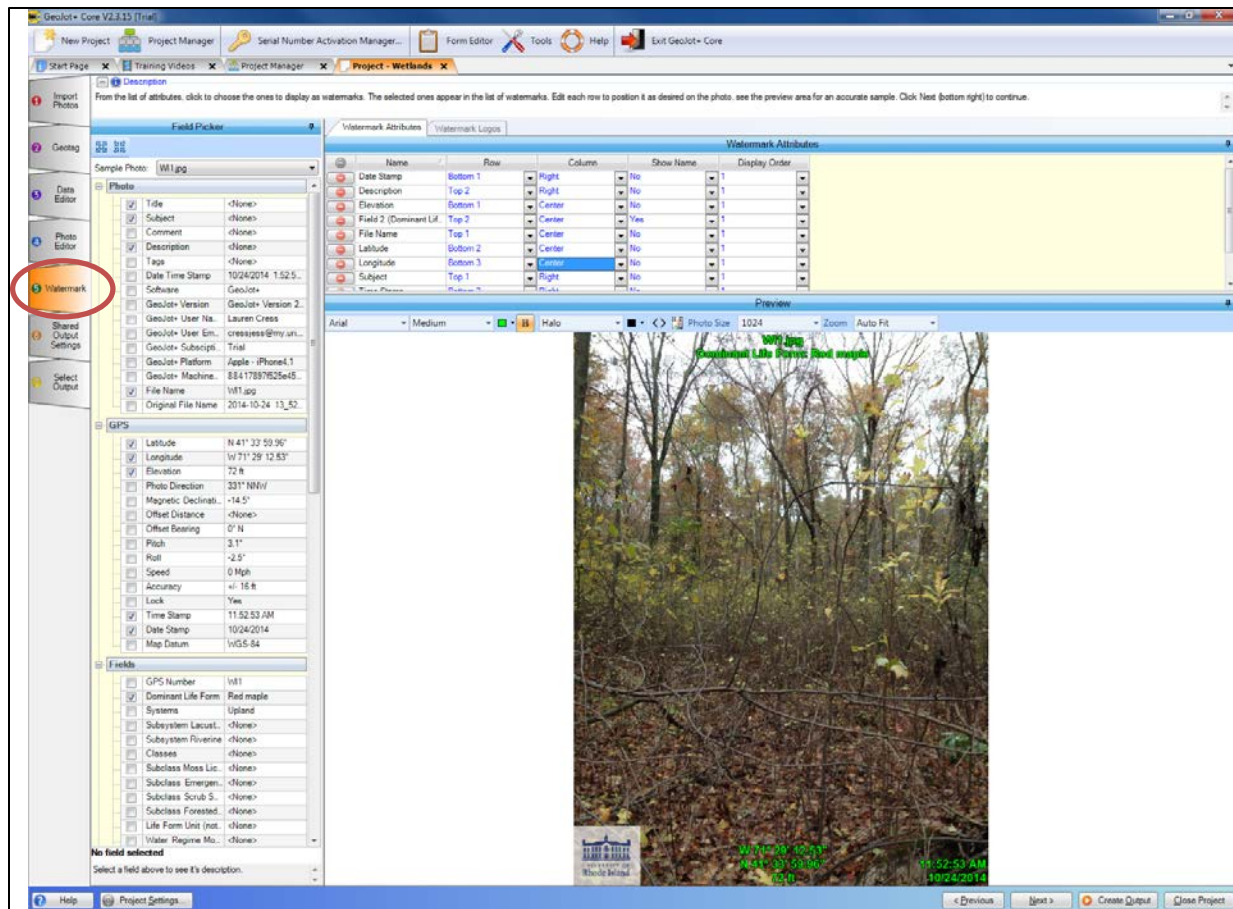


Figure 23. The “Watermark” tab allows you to add watermark data to the photo.

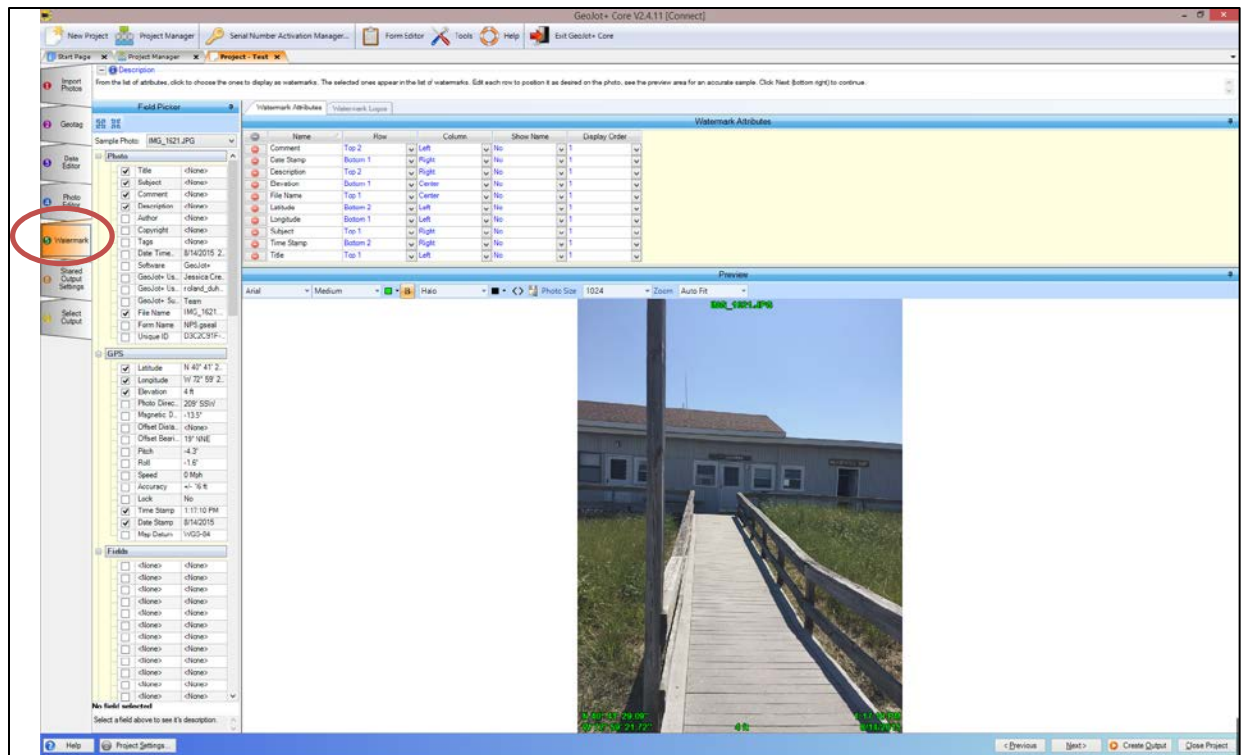


Figure 24. Another example of the “Watermark” tab screen.

Shared Output Settings Tab (Tab 6)

This is where you can choose the settings for the subsequently selected integrated outputs, such as items to show on the title page of the Word Document or PDF reports, base map settings for these reports (source, scale and size of each shared map), attribute table field selection (including URL outputs), and an attribute-based bulk photo renaming file format.

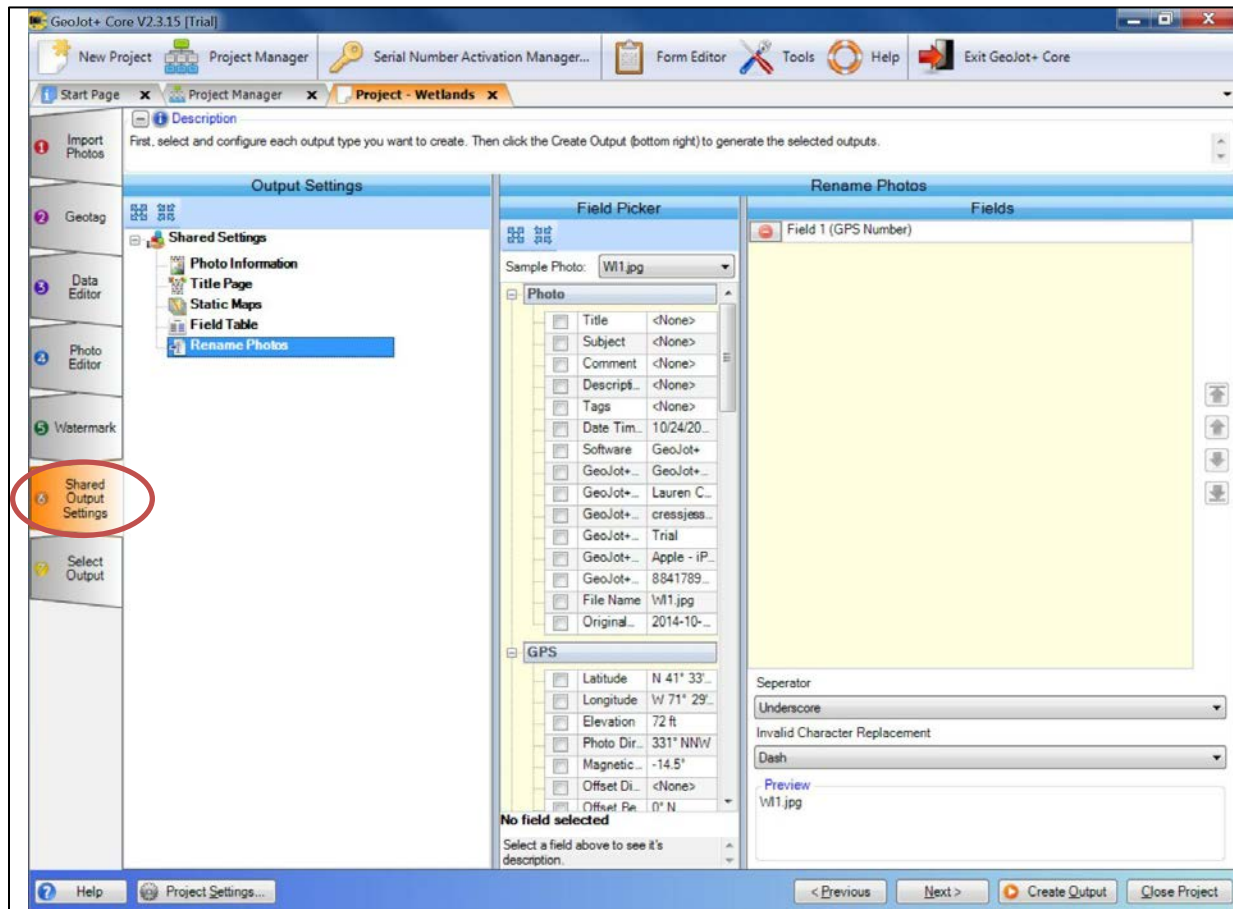


Figure 25. The “Shared Output Settings” tab (Tab 6) allows you to configure the settings for the “Select Output” tab (Tab 7).

Selecting Output (Tab 7)

In this tab you can select the type of report that is created, add a contact sheet and select the desired data file type (i.e. shapefile, Google Earth file, Access 2000 database file, etc.). Once finished, click the **Create Output** button on the bottom of the screen. All output items will be added to a new folder within the project folder called **Outputs**. You can then add this shapefile to ArcMap and enable hyperlinks by utilizing the layer properties dialog. Also note that you need to set the pathname of the **hyperlink base** to the **outputs** folder under **Map Document Properties** in ArcMap. Once both of these things have been done, the hyperlinks will work correctly and the image will open when clicked on with the hyperlink tool (lightning-bolt icon). For those with ArcGIS, there is a GeoJot toolbar that can be added to any ArcMap session. This is part of the GeoJot+ Core installation and you may find it useful for your specific application.

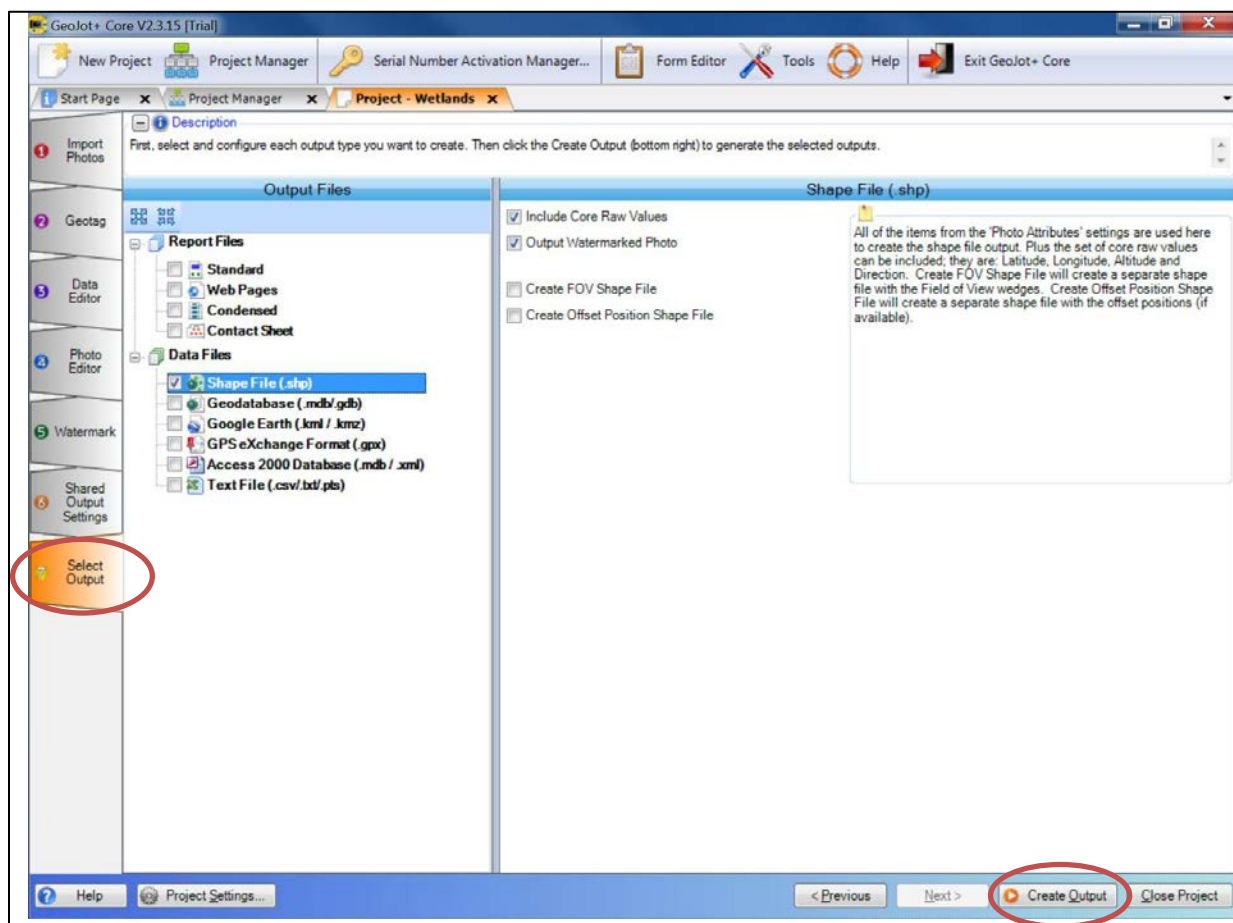


Figure 26. The “Select Output” tab (Tab 7) allows you to create Report Files, such as web pages. In addition, you can export GIS data such as shapefiles or file GeoDatabases. You can manage the settings for these outputs under the previous tab.

Assessing the Functionality of GeoJot+

GeoJot+ Core and the GeoJot+ app were tested in October, 2014 using a 15-day trial version subscription. The GeoJot+ app was used on both an iPad Mini 7 and an iPhone 4s. With each trial version subscription, five GeoJot+ Core and five GeoJot+ app licenses are made available to the account manager. Both desktop and mobile device installation was easy, and occurred without any major problems.

Cons

Spatial accuracy is an important factor for users to consider. We tested the accuracy of the iPhone 4s against a Garmin Oregon GPS in a wooded wetland in southern Rhode Island. The stated accuracy of the iPhone 4s coordinates from the GeoJot+ app was usually about +/- 5 m (see Figure 1 lower right corner). However, when we compared these locations to the ones collected using the Garmin Oregon, the average difference was about 8 meters, but ranged from 2.8 to 15.1 meters. This may present a problem if high accuracy is needed when collecting data. It should also be noted that we only tested the accuracy of the software using an iPhone 4s; other mobile devices such as Android phones, newer iPhones or iPads may provide better positional accuracy. Additionally, the GeoJot+ core software does allow you to edit the location of geotagged photos, but this is only useful if you know exactly where you were standing when the point was collected.

Another observation of the software is that in order to lock in the coordinates of a photo, you must hit **save** after filling out the form. On several occasions the testers walked away from the original location before realizing that the save button hadn't been clicked. The photo and its corresponding data are meaningless unless the exact location is stored.

The take home message here is to be patient when collecting data and be sure to click on save after filling out the form.

Caveate: GeoJot can be installed on the Garmin Monterra which has the same chip set as the Oregon. Gettag also has a better chip set than the IOS hand held devices. GeoJot+ mobile app can be run on window mobile devices such as Trimble. However, you can't average your points on Win Mobile devices. Even with this limitation, Brian Diethorn points out that the windows mobile device is the most accurate option. In short, Android and Win Mobile are more accurate than IOS.

Benefits

The simplicity of the GeoJot+ app made data collection fast and effortless. The application eliminates the need to carry multiple data sheets in the field and ensures uniformity in the data collected. A useful feature of GeoJot+ is that when creating a form, the user can set certain fields to **required**, so that when in the field, the collection screen will not save until all required fields have been entered. When GeoJot+ is integrated with Dropbox, all photos and data will be uploaded as soon as they are collected. This is an important feature when managing field crews with many members, or when responding to disaster situations. When automatically uploaded, the data will still need to be placed on a map. This is slightly different than the ArcGIS Collector Application which has the ability to do both in real time (upload the data and place them on a map or web application).

The GeoJot+ Core desktop software is straightforward to use. The seven step ribbon bar guides the user through all the necessary processing steps. The functionalities that we found useful include adding watermarks containing field attributes to each photo, the ability to change the location of a photo and the ability to change field values or bulk rename photos based on a single field.

Proposed Data Collection Methods

We recommend the collection of in situ data at each surge point location (Clear, unambiguous swash line) in the following way (Tefft et al., 2012):

1. Identify and obtain a GPS-based location of storm surge extents. Each location can be discovered by driving along the impacted shoreline shortly after landfall of a hurricane when it is safe to do so.
2. When a suitable location was identified, such as debris deposit lines (swash line), GeoJot+ software can be used to mark the location of this feature(s). When practical, it is a good idea to also record information within a field notebook. This information can include: time, date, person collecting the data, number of photos taken, GPS fix accuracy (as indicated by the GeoJot software).
3. After data are recorded, photographs of each site can be taken with the GeoJot+ app. Most locations should have two photos associated with them. 1) A close-up of the swash line, and 2) a perspective photo shot, so that the location can be easily compared against aerial photography of the area.

Conclusion

We propose that NPS use the GeoJot+ software for responding to major storm events. We also believe that other alternatives may become available as apps and GPS technology improve. Because of this, we recommend the continued exploration of future field data collection solutions as well as enhancements to future versions of the GeoJot+ application.

Citations

Ephemeral Data Collection Following Natural Disasters: Making the Best of a Bad Situation. October 2012

This project was based on the data collected on Superstorm Sandy. Swash line points (obtained through a Garmin GPS) were compared with a Digital Elevation Model, obtained from the April 2011 Northeast LiDAR project dataset, to determine swash point elevation; these elevations were then compared with the bathtub inundation model that has been developed for Rhode Island's coast to determine the accuracy of this model.

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Appendix A. Software usage videos from GeoSpatial experts

YouTube videos showing how to use GeoJot+ software:

GeoSpatial Experts Source Link:

<https://www.youtube.com/user/GeoSpatialExperts/videos>

Executive Briefing: Smartphones & Tablets for Pipeline Data Collection:

<https://www.youtube.com/watch?v=DXhpy2jIwmo>

Field Data Collection with Smartphones, Tablets and Lasers:

<https://www.youtube.com/watch?v=kADM7Ggd1b4>

The GeoJot+ App and TruPulse:

<https://www.youtube.com/watch?v=XofwzNAxwd4>

Updates and changes to the GeoJot suite of software:

<http://www.geospatialexperts.com/GeoJot+%20Versions.php>

Appendix B. NPS instructions for obtaining GeoJot software license for NPS data collection (from Brian Diethorn)

Note that NPS GPS-Photo Link is now NPS GeoJot!

The NPS has 100 floating enterprise licenses of the **GeoJot+ geotagged image data collection system** ready for use Servicewide. The NPS GeoJot+ system consists of the **GeoJot+** mobile app (field data collection software) and **GeoJot+ Core** (desktop data collection and data management software). All licenses are managed by the NPS Resource Information Services Division (RISD). **To register for the NPS versions of both the mobile app and desktop software go to (behind NPS firewall) [this link](http://share.inside.nps.gov/sites/IR/RIM/DIM/Lists/GPSPhotoLink%20License%20Request%20Form/NewForm.aspx?RootFolder=)** (<http://share.inside.nps.gov/sites/IR/RIM/DIM/Lists/GPSPhotoLink%20License%20Request%20Form/NewForm.aspx?RootFolder=>). This site includes:

- Link to NPS GeoJot website which includes desktop and mobile software download, installation info, training videos, functionality list, and contact info.
- Required activation serial number (same for both the desktop software and mobile app).
- Digital Photo Metadata Standard GeoJot form for NPS Focus processing.
- A brief set of questions about how GeoJot+ will be used by you and your Park/Program.

Appendix C. Additional USGS post-storm data collection procedures

In addition to physical destruction of both buildings and the landscape, storms and associated flooding can affect the quality of our Nation's water resources. The USGS responds to major events that can affect water quality by working with local, State, and Federal agencies and the citizenry to identify, quantify, and understand environmental issues and concerns. During and after flooding events, the USGS may collect additional water samples to help us understand how the hurricane and any associated flooding is affecting water quality in the short and long term. The frequency and location of water sampling varies by local conditions and depends on the needs and concerns of our

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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