

Digital Orthophoto Mosaic for Weir Farm National Historic Site

Submitted to:

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Insert in Materials and Methods Section of Vegetation Mapping Report

Aerial Photography Acquisition and Processing

Aerial photography for a digital orthophoto mosaic of Weir Farm National Historic Site was initially acquired in the spring of 2003, during leaf-off conditions, by William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH); however, the photography was blurry and unusable for the intended purposes. New photography could not be acquired until spring of the following year, so the mapping was started with older, existing photography and resulted in a delay in this vegetation mapping project. Frament acquired the color infrared, stereo pair 1:8,000 scale aerial photography used for the mosaic from an overflight on May 12, 2004, again, during leaf-off conditions. The photography was delivered to North Carolina State University (NCSU) where the air photos were counted to make sure that none were missing, scanned, and placed in the air photo archive maintained at NCSU for the NPS Northeast Region Inventory & Monitoring Program. Associated data and information provided by Frament, and also stored in the air photo archive, include the camera calibration certificate for the camera, a shapefile of the photo centers, and a hard copy air photo index.

The mosaic was produced from 3 color infrared air photos scanned at 600 dpi with 24-bit color depth. The scanned images of the air photos were imported into ERDAS Imagine (.img) format where a photo block was created using a USGS digital elevation model (DEM) and USGS digital orthophoto quadrangles (DOQQs) as reference. In preparation for this step, the DEM was resampled from 30 meters to 10 meters and the DOQQs were mosaicked. The photo block was manipulated until it could be triangulated with a root mean square error of less than 1. At this point, single frame orthophotos (one for each air photo) were generated within Imagine and exported to Imagine .lan format. Then the .lan files were imported into ER Mapper's native (.ers) format, and an ER Mapper algorithm was created which contains the color balancing information and the cutlines created for the final mosaic. In ER Mapper a band interleaved by line (.bil) image and header file of the final mosaic was generated, the .bil image was imported into Imagine .img format, and, finally, the .img image was compressed using MrSID software with a 20:1 compression ratio.

A metadata record for the mosaic was prepared according to current Federal Geographic Data Committee standards (FGDC 1998a). Metadata were produced in notepad and parsed using the USGS metadata compiler program (MP) to locate errors and omissions (USGS 2004). After all errors and omissions were corrected, MP was used to generate final TXT, HTML, and XML versions of each metadata record which are stored in the air photo archive. Key information for the Weir Farm National Historic Site mosaic is summarized in Table 1.

To facilitate vegetation mapping work already underway when the mosaic was completed, the mosaic was delivered to the State Geological and Natural History Survey of Connecticut in the CT State Plane coordinate system (NAD83, feet). The final vegetation mapping products will be delivered in the appropriate UTM (NAD83, meters) projection according to national vegetation mapping standards.

Insert in Accuracy Assessment Section of Materials and Methods Section

Positional Accuracy Assessment

The horizontal positional accuracy of the mosaic was assessed using guidelines of the USGS/NPS Vegetation Mapping Program (ESRI, NCGIA, and TNC 1994). Well-defined positional accuracy ground control points, spaced throughout all quadrants of the mosaic, were placed on the final mosaic in ArcMap. Ground control points and zoomed-in screenshots of each point were plotted on hard copy maps with the mosaic as a background. These maps and plots were used to locate the ground control points in the field. For each plotted ground control point, field staff noted any alterations to the locations in the field, and then recorded the coordinates with a Trimble Pro XR/XRS or GeoXT. Mapped ground control points that were physically inaccessible were also noted. The field crew correctly located and collected accuracy assessment data at 12 ground control points.¹ The coordinate data were collected with real time GPS and post processed with differential correction using Pathfinder Office software. Prior to calculating accuracy, one ground control point, identified as an outlier with SAS's JMP program, was removed. For each of the remaining 11 points, the field-collected "true" or "reference" GPS coordinates were compared to the coordinates obtained from the mosaic viewed in ArcMap. Both pairs of coordinates for each point were entered into a spreadsheet in order to calculate horizontal accuracy (in meters). The accuracy calculation formula is based on root mean square error (FGDC 1998b; Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center 1999). Figure 1 shows the distribution of these 11 ground control points within the park and surrounding area.

¹ USGS/NPS Vegetation Mapping Program guidelines recommend a minimum of 20 ground control points for accuracy assessment regardless of park size. NPS personnel were responsible for collecting accuracy assessment data for this park and provided ground control data for only 12 points.

Insert in Results Section

Accuracy Assessment

Positional Accuracy

The final horizontal positional accuracy for the mosaic is 3.85 meters and meets Class 2 National Map Accuracy Standards (FGDC 1998b). A copy of the spreadsheet that contains the x and y coordinates for each ground control point and the accuracy calculation formula is included in the air photo archive.

Figure 1. Ground control points (n=11) used to calculate horizontal positional accuracy of the Weir Farm National Historic Site mosaic

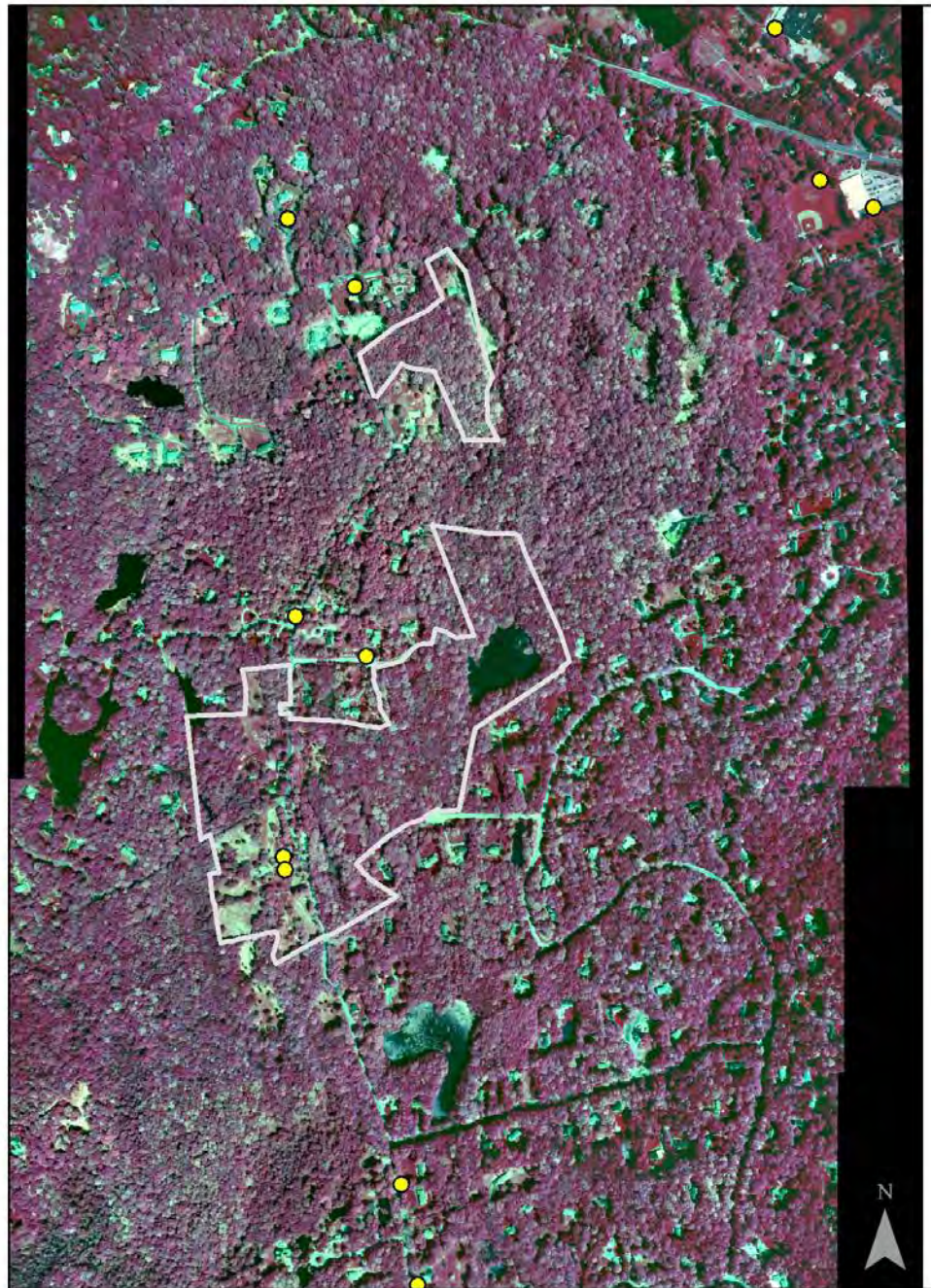


Table 1. Summary of key information for Weir Farm National Historic Site mosaic

Title of metadata record:	Weir Farm National Historic Site Color Infrared Orthorectified Photomosaic (ERDAS Imagine 8.7 IMG and Mr.SID formats)
Publication date of mosaic (from metadata):	December 1, 2004
Date aerial photography was acquired:	May 12, 2004 (leaf-off conditions)
Vendor that provided aerial photography:	William Frament, USDA Forest Service (Northeastern Area State and Private Forestry, Durham, NH)
Scale of photography:	1:8,000
Type of photography:	Color infrared, stereo pairs
Number of air photos delivered:	3
Archive location of air photos, camera calibration certificate, shapefile of photo centers, and hard copy air photo index:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi, 24-bit color depth
Horizontal positional accuracy of mosaic:	3.85 meters, meets Class 2 National Map Accuracy Standard
Number of ground control points upon which estimated accuracy is based:	11
Method of calculating positional accuracy:	Root mean square error (RMSE)
Archive location of mosaic and metadata:	North Carolina State University, Center for Earth Observation
Format(s) of archived mosaic:	.img (uncompressed); MrSID (20:1 compression)

Literature Cited

Environmental Systems Research Institute (ESRI), National Center for Geographic Information and Analysis (NCGIA), and The Nature Conservancy (TNC). November 1994. Accuracy assessment procedures, NBS/NPS Vegetation Mapping Program. Retrieved October 2001 from <http://biology.usgs.gov/npsveg/aa/aa.html>.

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