

APFO DIGITAL GLOBE IMAGERY EVALUATION

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Outline

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- Spatial Resolution
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- Viewer Capabilities
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Introduction

- Last year APFO evaluated several samples of Digital Globe WorldView-2 8 band imagery
- This year we evaluated WorldView-2 Hawaii imagery in several delivery formats including: 8-bit DRA on, 8-bit DRA off, 16-bit radiometrically balanced and 16-bit original values
- The data was analyzed mainly from the perspective of NAIP (substitute, filling in holes, etc.)
- Other considerations during analysis were usefulness for Resource imagery projects, remote sensing applications, and usefulness to FSA.



Digital Globe Image Samples

- Provided “standard imagery products”
 - Radiometrically and sensor corrected
 - Projected to a standard projection and datum of the customer’s choice
 - Consistent Ground Sample Distance throughout the image
 - Geo-TIFF format



Radiometric Resolution

- Imagery provided was unsigned 16-bit 8 band although 8-bit delivery is an option according to the Digital Globe Core Imagery Products Guide
- Current NAIP imagery is 8-bit 4 band multispectral imagery
- Range in values for 16-bit imagery is 0 - 655535 compared to 8-bit 0-255

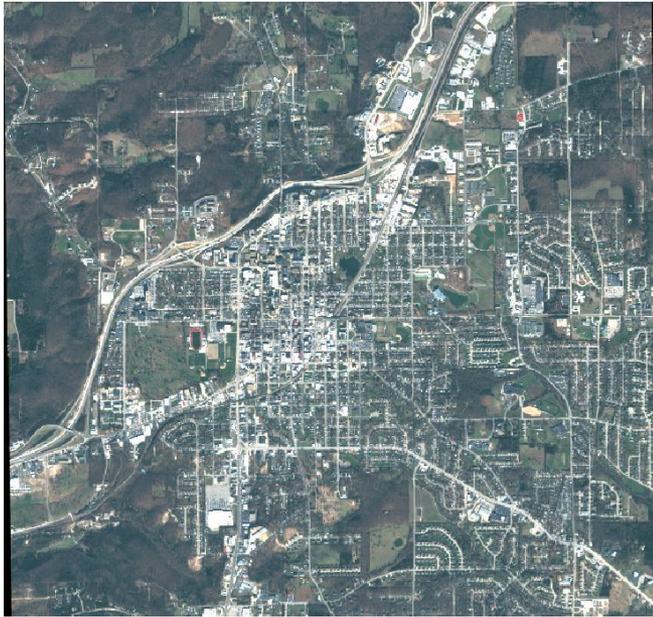


Radiometric Resolution (cont)

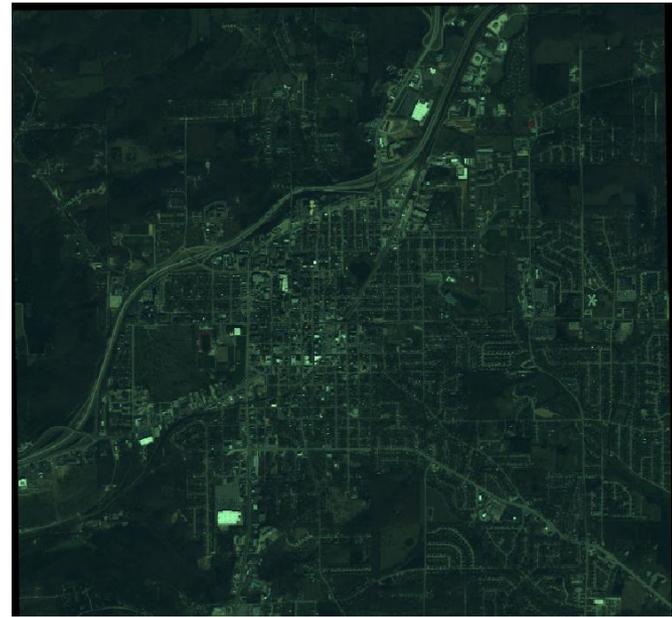
- 16-bit imagery is rendered as black or nearly black in ArcGIS
- A standard deviation stretch of 2 applied to the imagery facilitates viewing
- RGB rendered values for a 16-bit image are displayed as an 11-bit image in ArcGIS and ERDAS Imagine with values ranging from 0-2047



Stretched Image Compared to Unstretched Image



Stretched Image



Unstretched Image



Radiometric Balancing

- Original samples were radiometrically balanced
- Hawaii samples raw and were radiometrically balanced
- NAIP imagery is radiometrically balanced
- APFO has the capability to radiometrically balance the raw data, but considering current workloads and most FSA uses and current business practices, it would be more efficient to have radiometrically balanced data provided by Digital Globe



Spatial Resolution

- Samples were 2-meter with a 0.5 meter panchromatic band
- 2-meter imagery spatial resolution would not meet NAIP specifications, so imagery would need to be pan-sharpened
- ArcMap will Pan Sharpen the imagery on the fly for viewing
- Higher resolution would be useful for Resource photography projects



Image Samples



NAIP - 1 Meter Resolution



WorldView2 - 2 Meter Resolution



WorldView2- Pan Sharpened to 0.5 Meter Resolution



Pan Sharpening

- Pan Sharpening in-house at APFO presents challenges with processing, storage and image tile size
 - Original Multispectral image 150 MB
 - 4 band Pan Sharpened 1.18 GB
 - 8 band Pan Sharpened 2.35 GB
- At this time, it is more efficient for FSA to acquire Pan Sharpened imagery from Digital Globe or another agency



Pan Sharpening Algorithms



Original



Wavelet



Brovey



Simple Mean



Imagery Users

- Current NAIP imagery is available to a variety of users
- Many users such as the county offices have access to professional software such as ArcMap
- Other users rely on free viewers to view and use the imagery



Viewer Capabilities

- Geo-TIFF format allows a number of free viewers to open the imagery but some are limited in the ability to utilize 16-bit 8-band imagery
- Global Mapper opened the imagery and allowed the user to look at different band combinations
- ER Viewer opened the imagery but the display was very dark and no ability to change band combinations



Viewer Capabilities (Cont)

- ArcGIS Explorer was not able to utilize the 8-band capability and did not display the imagery in the preferred 5,3,2 band sequence for natural color
- TatukGIS viewer was not able to display the imagery correctly
- The ability of users to view and use the Digital Globe imagery without having ArcMap, ERDAS, or other professional software is more limited than their ability to view NAIP



Advantages of WorldView-2 Imagery for FSA

- 8 band imagery would be ideal for image classification
- Classification accuracy improved
- Red Edge band valuable for vegetation analysis and subtle changes in plant health
- Broad agricultural considerations – plant disease, crop health, crop yield, precision agriculture and plant discrimination



Disadvantages of WorldView-2 Imagery for FSA

- Multispectral imagery not fine enough resolution for programs like NAIP and Resource photography
- 8 band imagery requires more storage
- Relatively small user group that would take advantage of the extra information provided by the 8 band imagery
- Training would have to be provided to users, including quality assurance personnel



Looking Ahead

- When more of the planned remote sensing applications and processes are better defined (Native Sod, Disaster response) and storage and delivery systems are updated, FSA may be able to better leverage 16-bit raw data
- 8 band data could improve many agricultural monitoring activities such as insect infestations, crop health, drought monitoring and change detection
- When the Hawaii imagery is available to users we should get a better idea of the advantages and disadvantages of this type of imagery

