

Determination of Vegetation Communities of Big Pine Key Using Historical Aerial Photographs in a GIS

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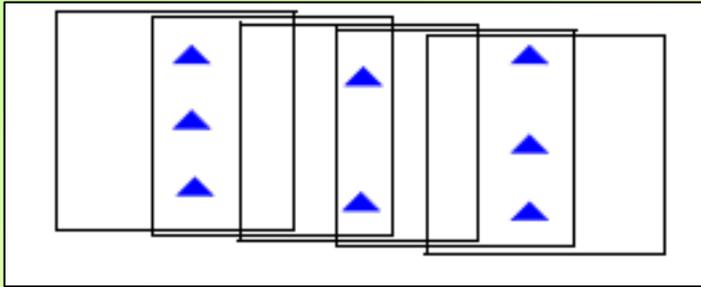
Historical Aerial Photographs

Benefits:

- Quality images (B&W) available for Florida Keys starting in 1959
- Provide baseline for landscape and vegetation analyses prior to extensive modification and development

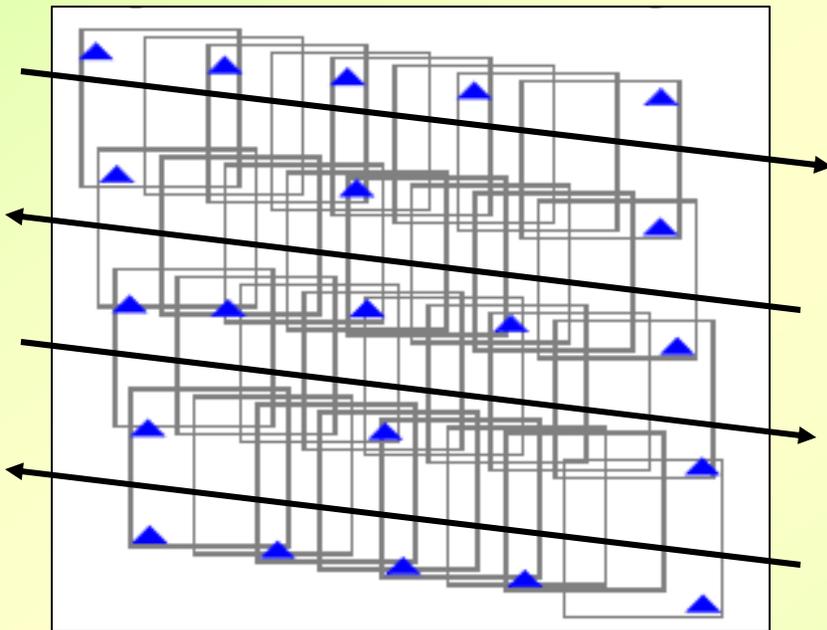
Challenges:

- Camera specifications and calibration marks on photographs needed for computerized processing are not present
- Early images lack stable landmarks to establish accurate ground control points
- Older images are scanned from either images or negatives



Aerial Photographs:

- Taken in a series of back-and-forth passes over an area
- Typically overlap by 60% in the direction of flight

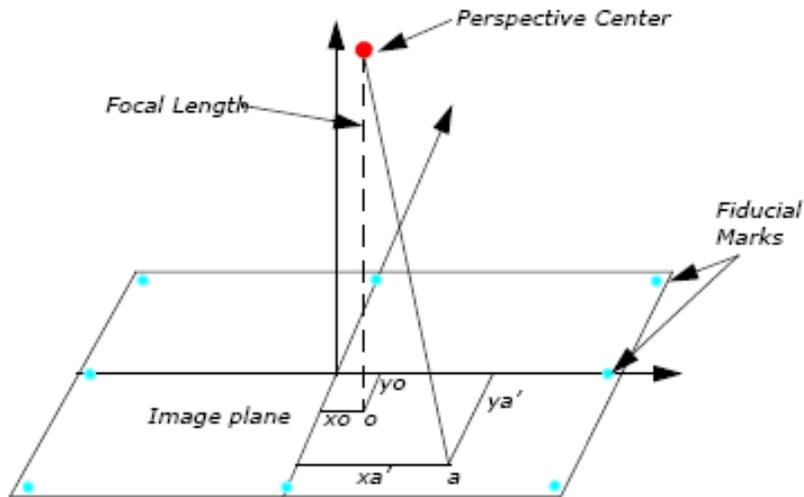


- Also overlap 20-30% along adjacent passes
- Overlapping images allow stereo viewing to estimate heights of objects
- Computerized methods can correct entire image set to reduce errors and the number of ground control points needed

1959 B&W Images

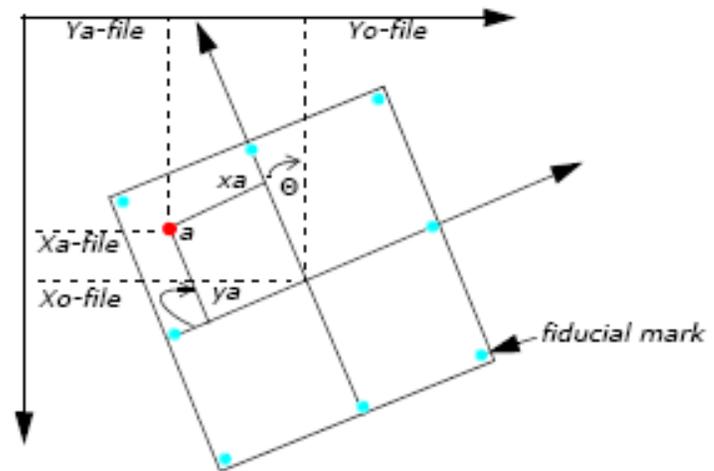
- Obtained from Florida Department of Transportation
- Date photos taken – 2/22/1959 from 9:03-10:15 am
- Photos are scanned at 14 m μ (1800 dpi) and saved as MrSID (1:20 compression)
- Flight height 9600 feet (2926 m)
- Scale 1:19,200
- Fairchild T-11 camera with lense focal length = 153.497 mm
- Images do not have fiducial marks
- Calculated ground coverage per pixel = 0.21-0.38 m (~1 foot)

Figure 12: Internal Geometry



Establish relationship between camera, image and the ground

Figure 13: Pixel Coordinate System vs. Image Space Coordinate System



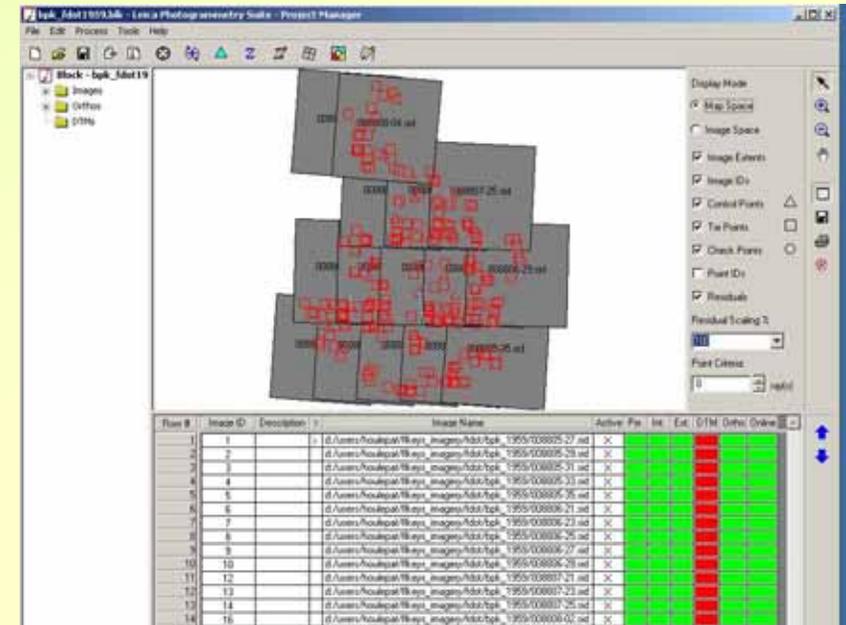
When camera calibration report is not available:

- Assume 6 inch lense focal length (152.4 mm)
- Measure 4 corner fiducial marks at borders of image using measurement tool and calculate as (+/- h/2 and +/- w/2)
Width/height of photo = (No. pixels/scanning resolution) * 25.4
Sign of coordinates depends on orientation of photo
- Assume principal point is at image center
- Set exterior orientation parameters = 0 and let program calculate

From Yusuke Niwa, ESRI Japan

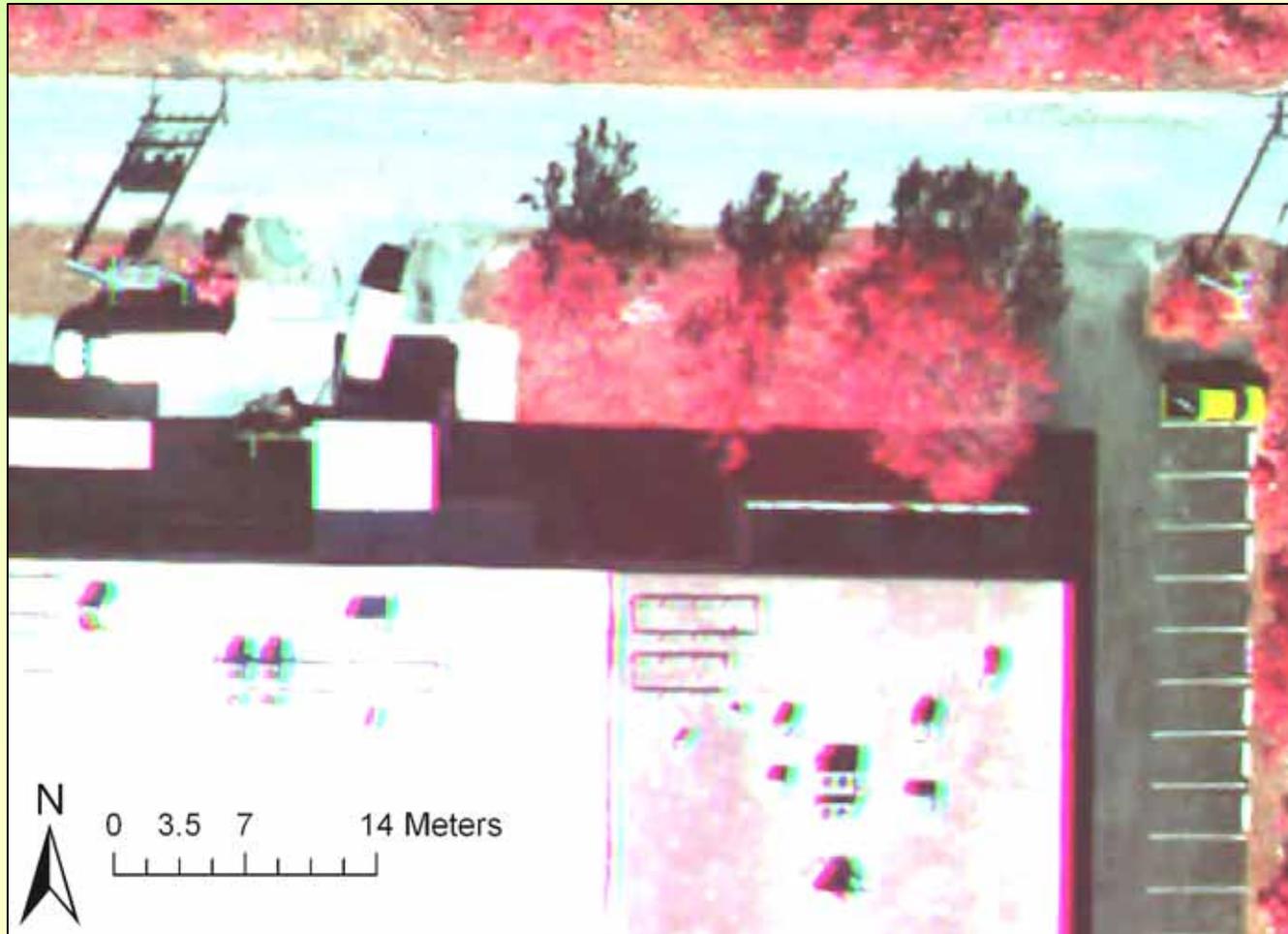
Use ground control points (GCP) to establish map coordinates

Tie points are common features found in more than one image

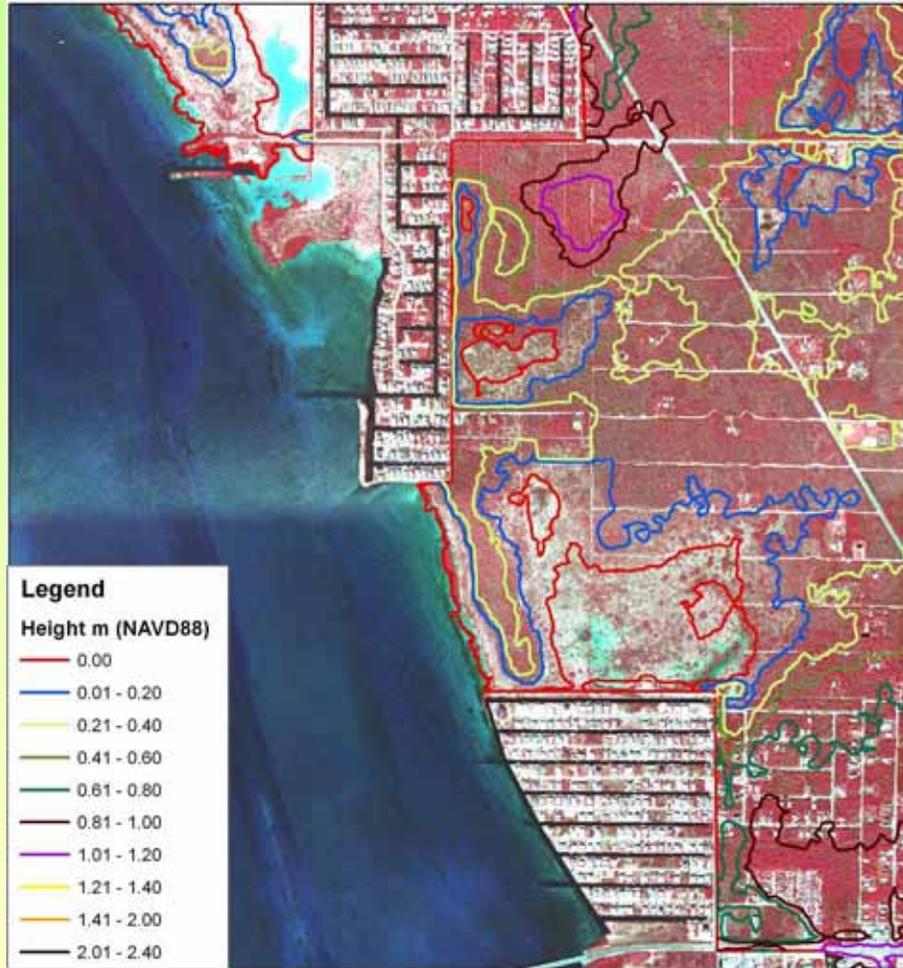


RMS error in georeferencing images ~2-3 meters

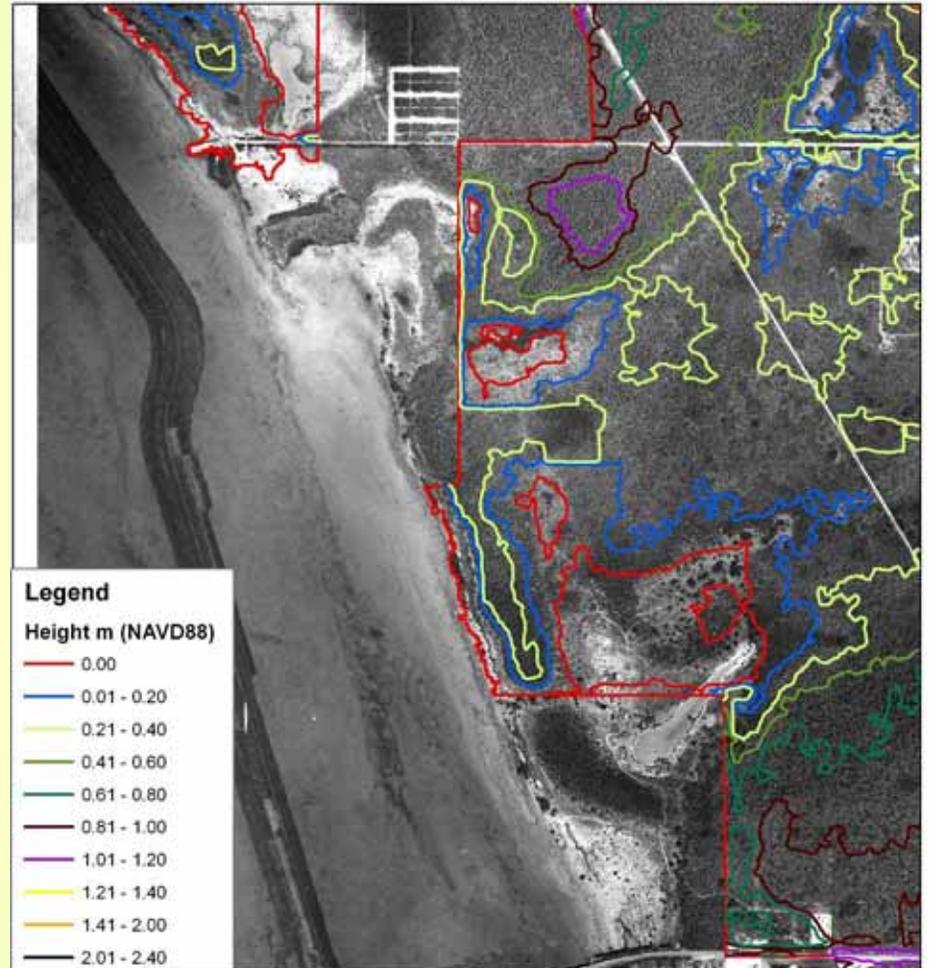
Relief Displacement – Tall objects lean away from principal point (Includes trees also)



Big Pine Key Close-up of Area Modified by Development

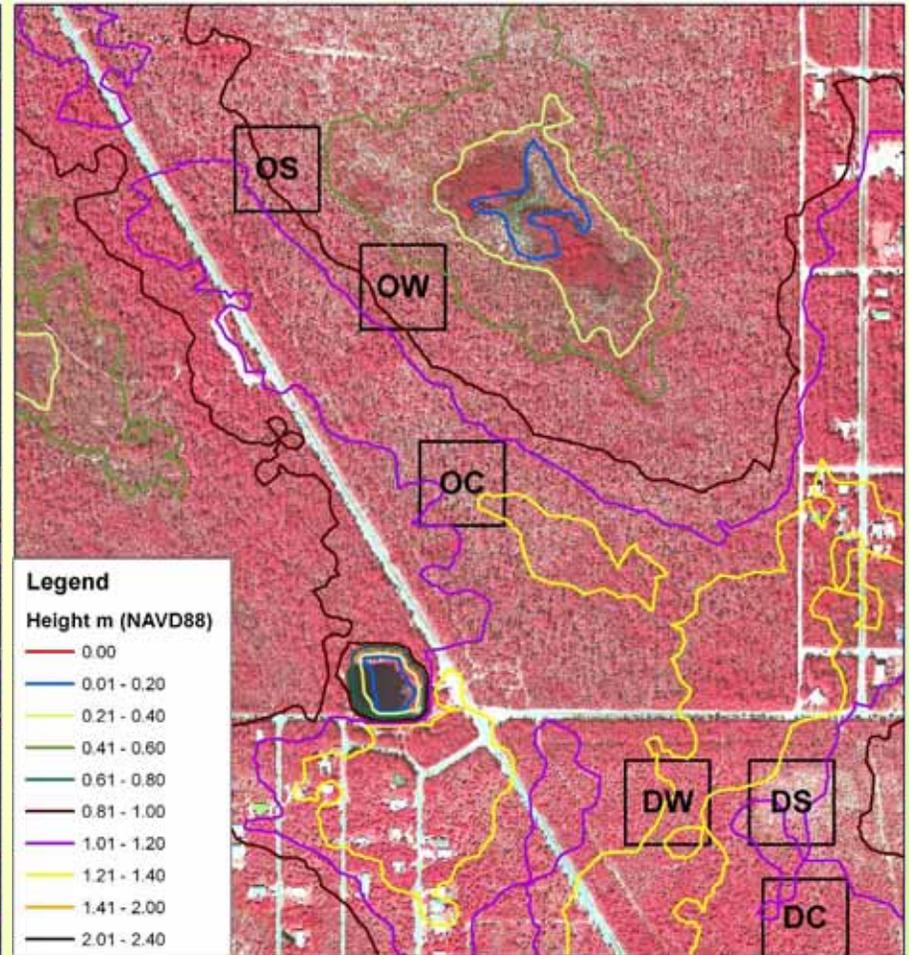
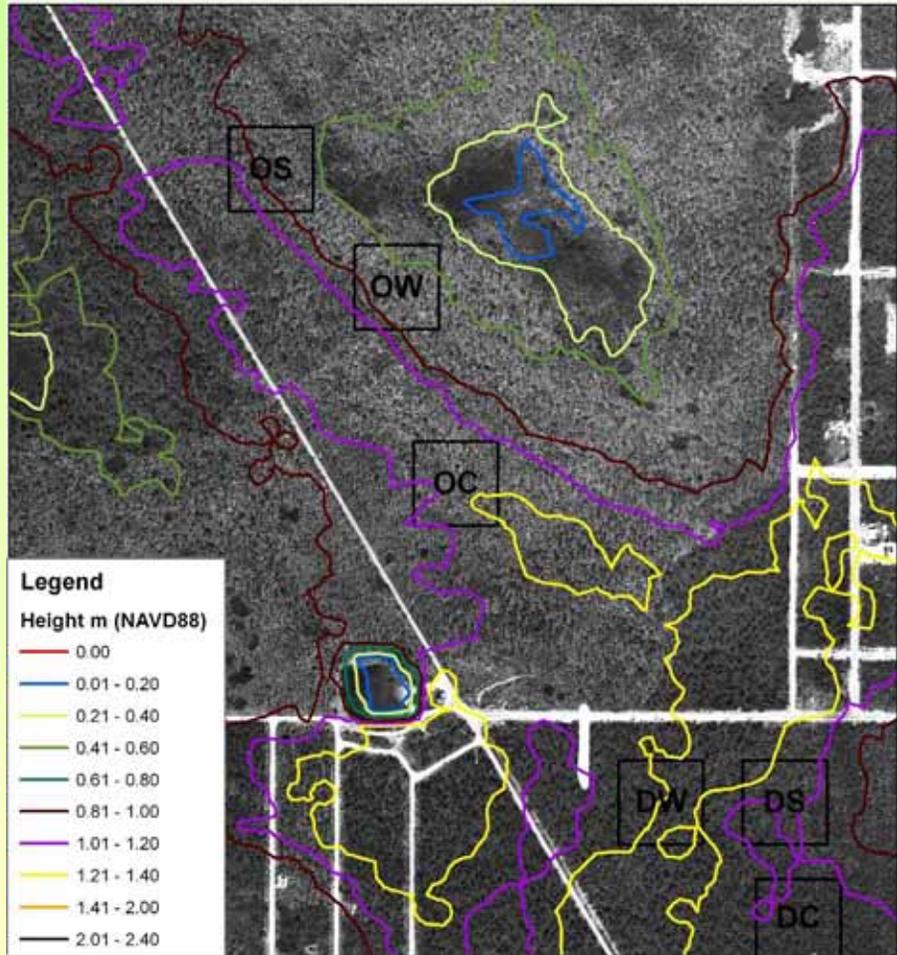


0 235 470 940 Meters

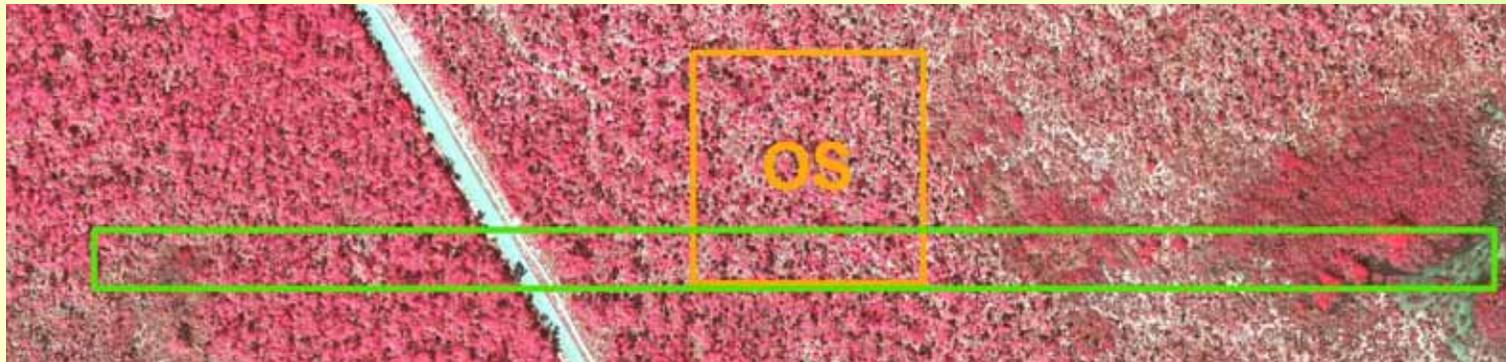
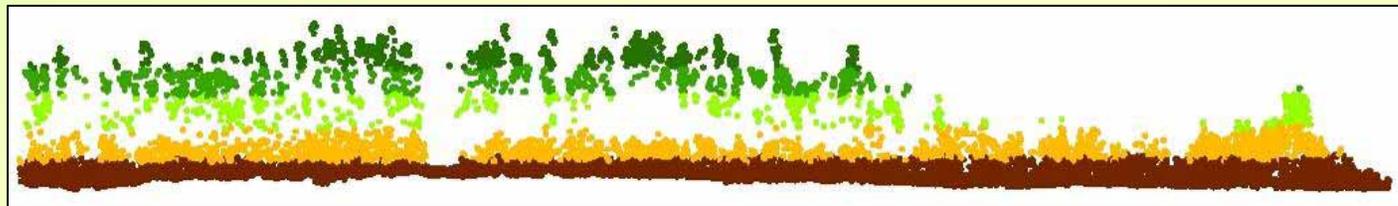
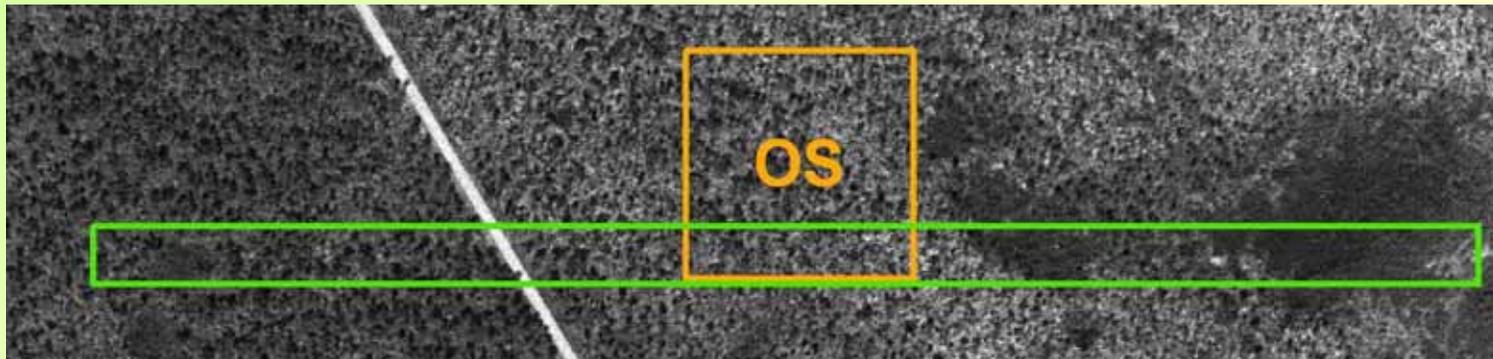


0 235 470 940 Meters

Big Pine Key Pine Forest Area

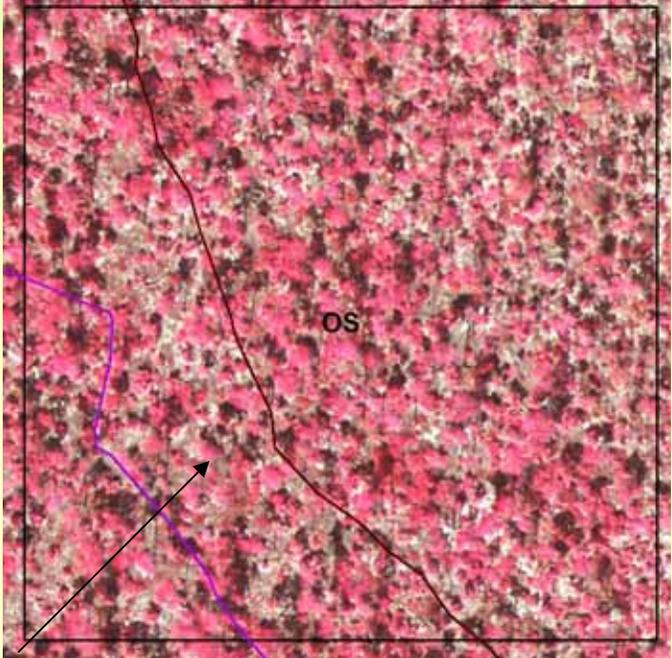
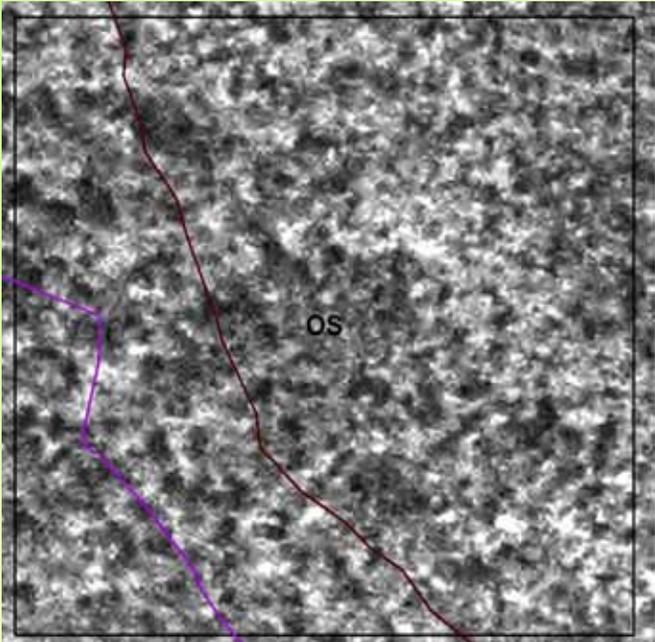


Vegetation Analysis of E-W Transect through Plot OS



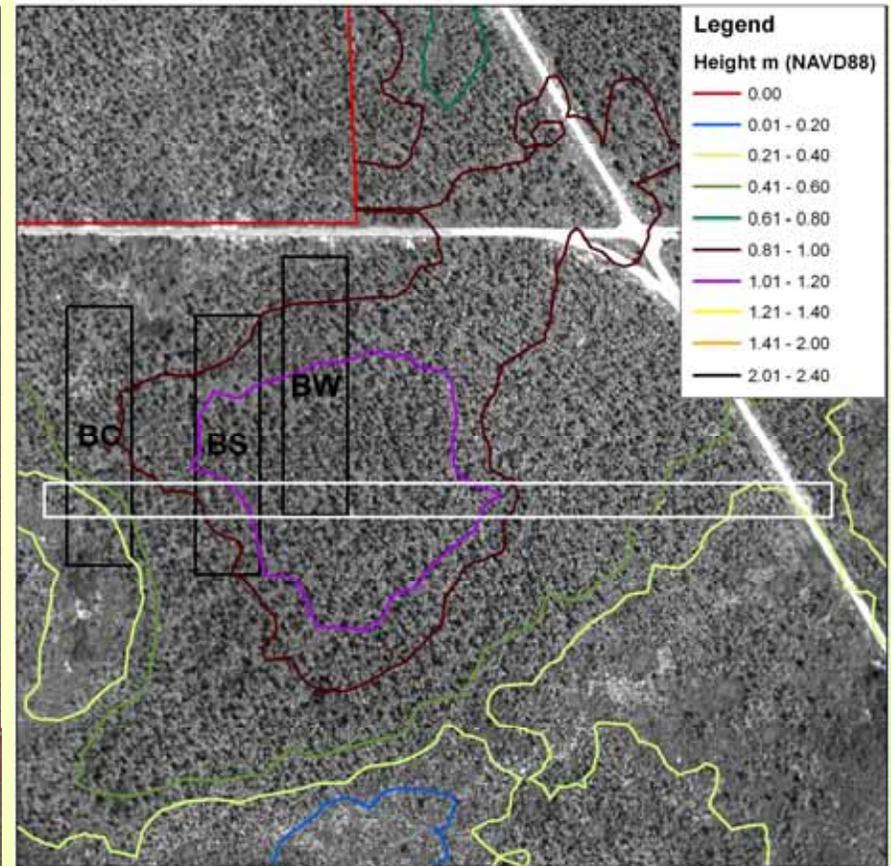
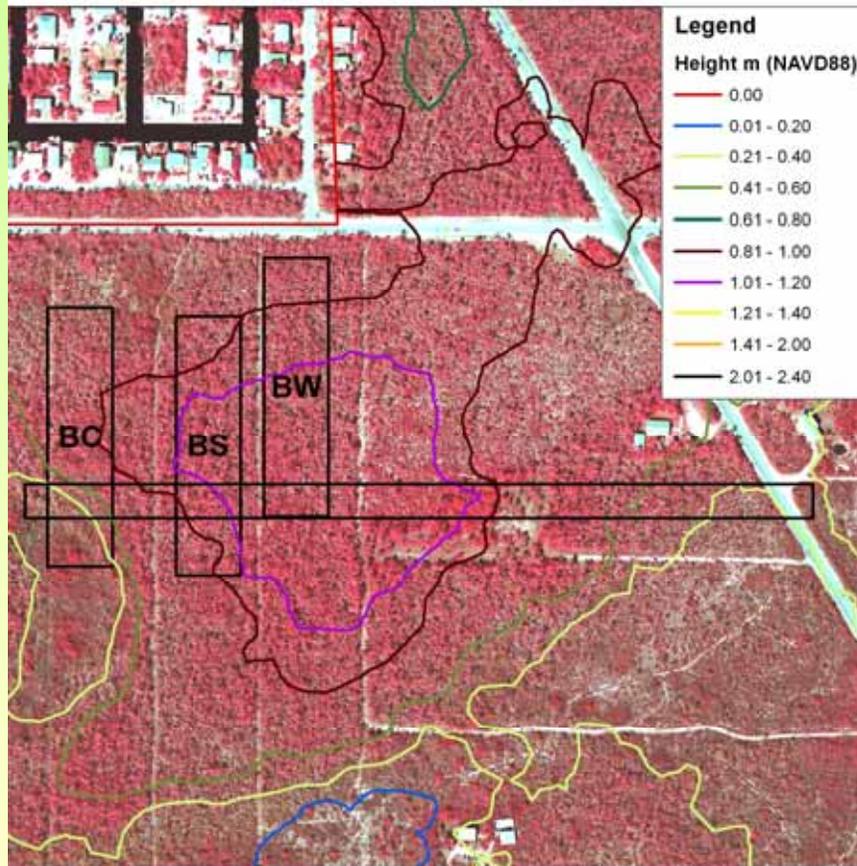
Brn: 0-2 m; Org: 2-5.3 m; Lt Grn: 5.3-8.5 m; Grn: 8.5-11 m; Dk Grn: 11-15 m

Plot OS Image Close-Up

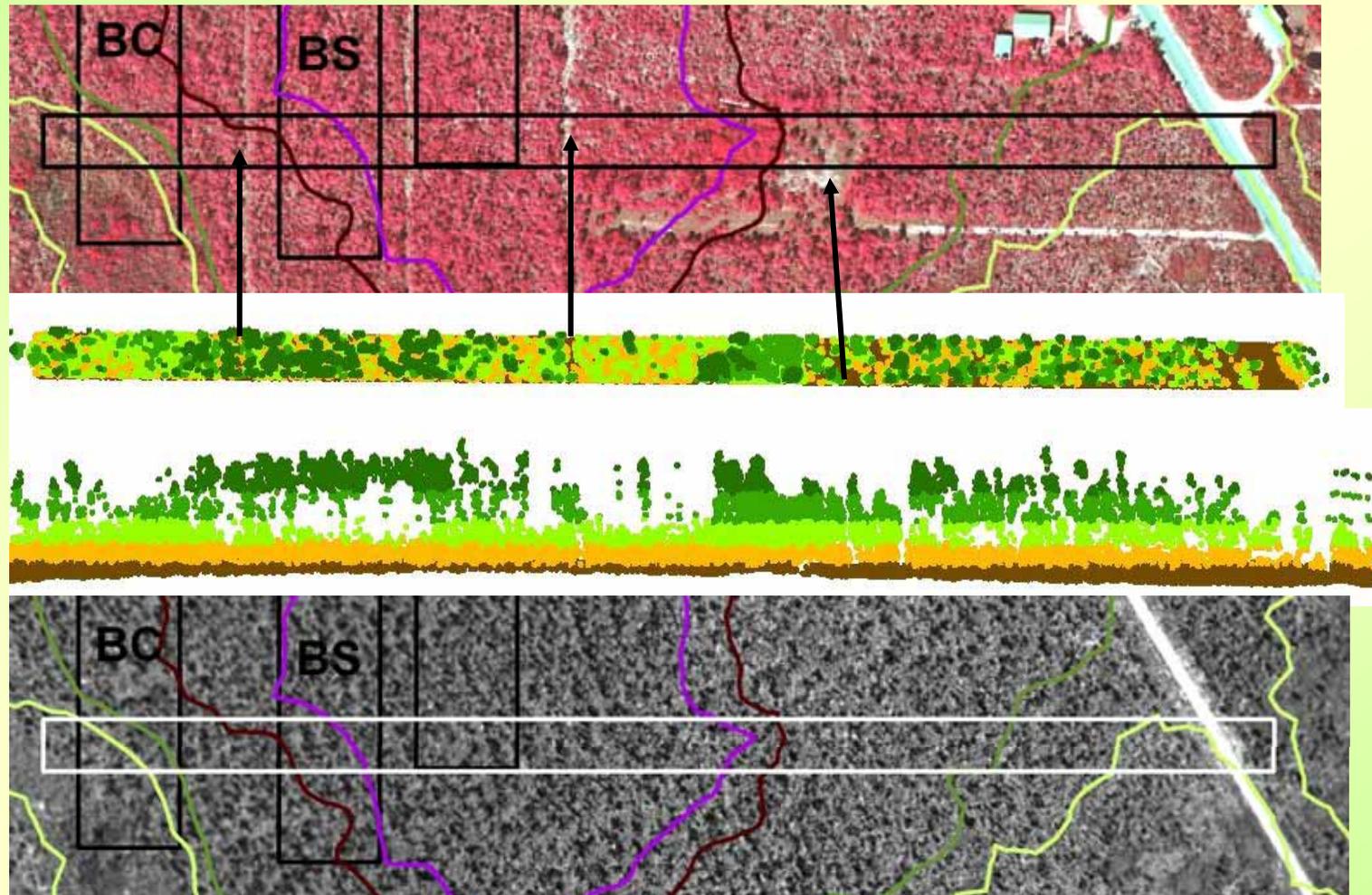


Danielle Ogurcak

Wide View of Area of TNC Preserve and B Series Plots



Vegetation Profiles for TNC Hammock Area



Brn: 0-1.8 m; Org: 1.8-3.7 m; Lt Grn: 3.7-6 m; Grn: 6-8.8 m; Dk Grn: 8.8-14 m

Summary:

- Historical aerial photographs (FDOT) are a valuable resource for visual examination of changes in vegetation landscape
- For landscape pattern analysis, images can be sufficiently georeferenced although camera calibration and other metadata is not available
- Image mosaicking is challenging due to color-balancing of individual images
- High resolution (0.5 foot) 2006 images (Monroe County GIS) and LIDAR can be used as a reference to aid in classification of vegetation in historical images



K. Zhang, March 2007

