Coastal Wetland Mapping Using Very High-Resolution Satellite Imagery: Tampa Bay Case Study

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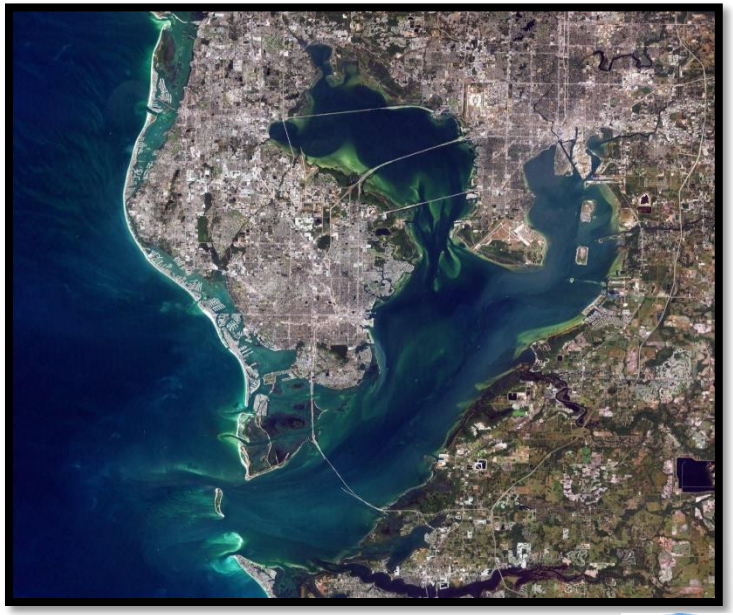
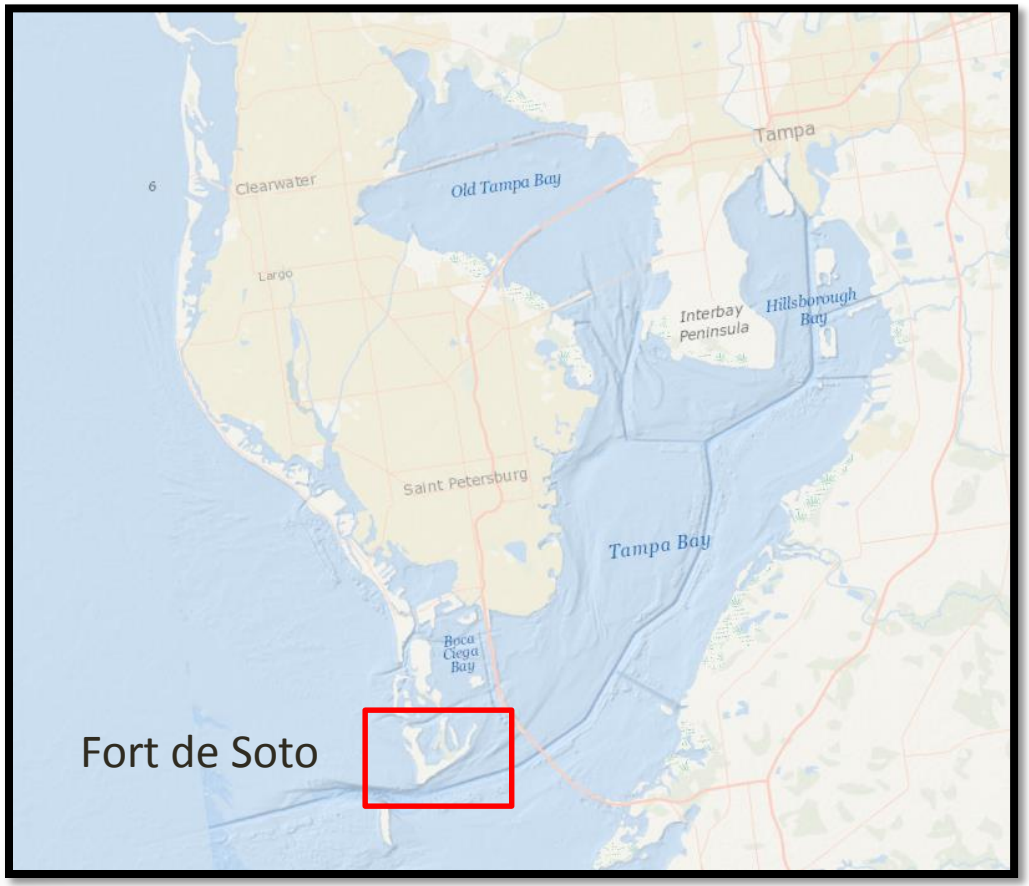


Institute for Marine Remote Sensing

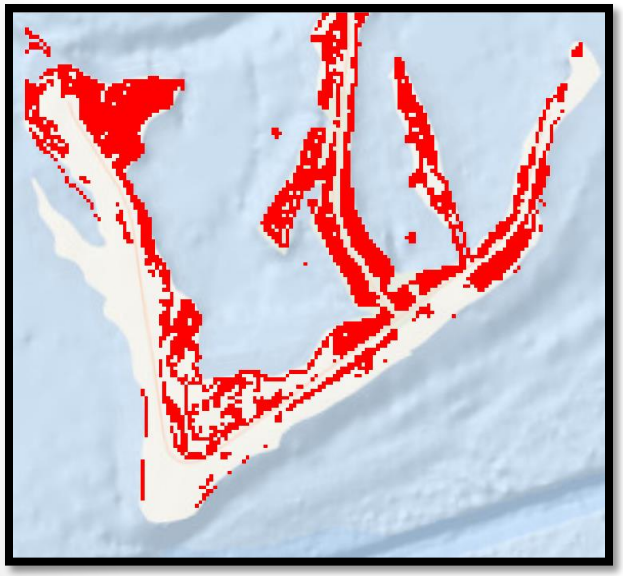
Introduction

- Need for improvement
  - Wetland classification challenges:
    - Misclassification with adjacent vegetation
    - Spatial Resolution (accuracy and precision)

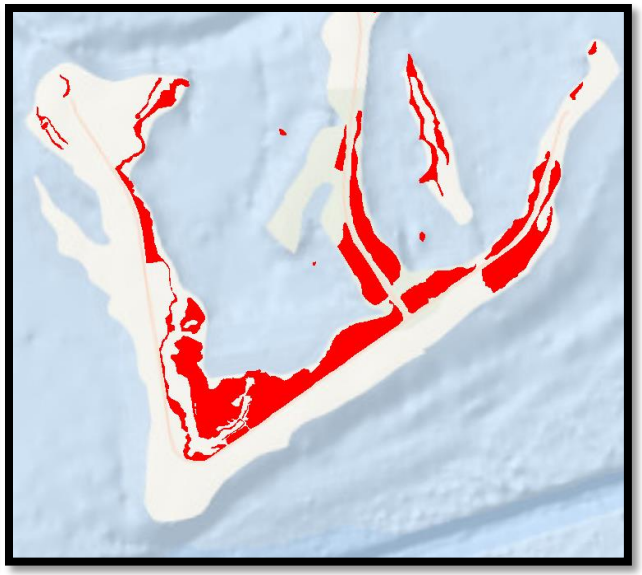


Wetland Map Inconsistencies

NOAA Coastal Change Analysis Program (C-CAP) 2010



Southwest Florida Water Management District (SWFWMD) 2011



National Wetland Inventory (NWI) 2009

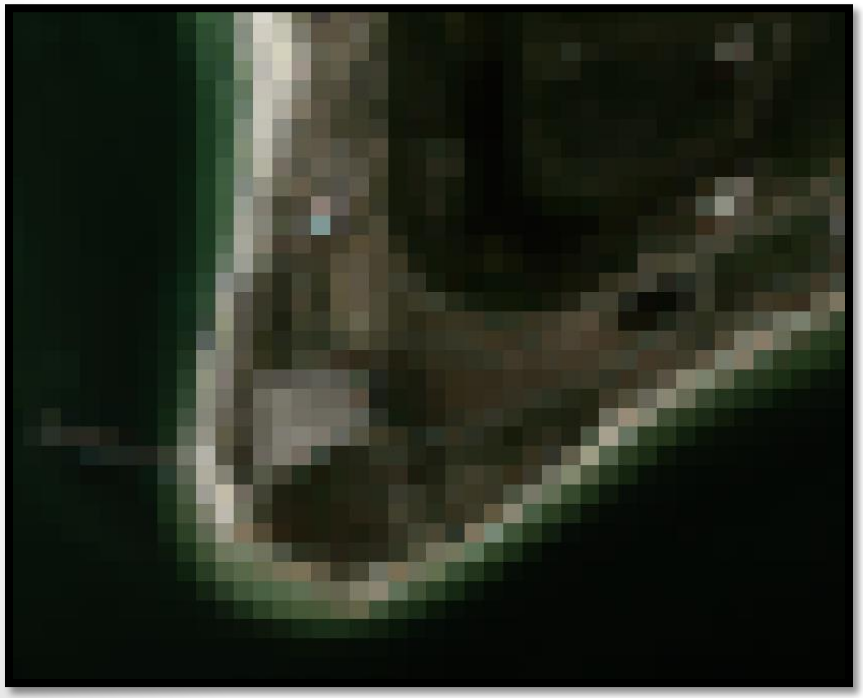
How to Improve Classifications?

- Use satellite-images:
  - Continual monitoring
  - Unbiased sampling
  - Digital data = automated classification methods
  - Efficient and objective
- Use high-resolution imagery:
  - More detail = higher precision & greater accuracy

Study Purpose:

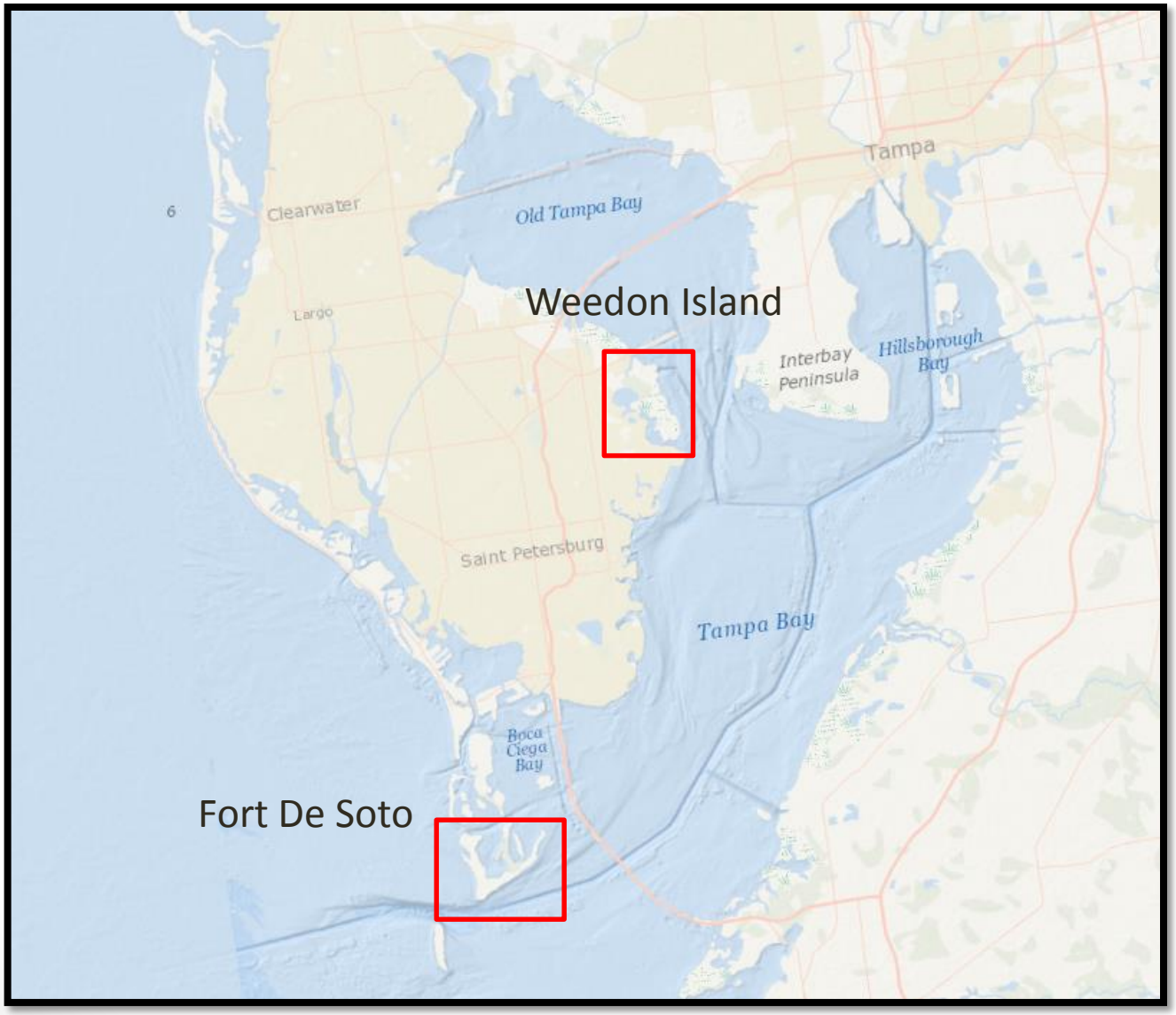
Develop efficient wetland-mapping method to apply to high-resolution satellite imagery

Landsat 8:
30 meter resolution

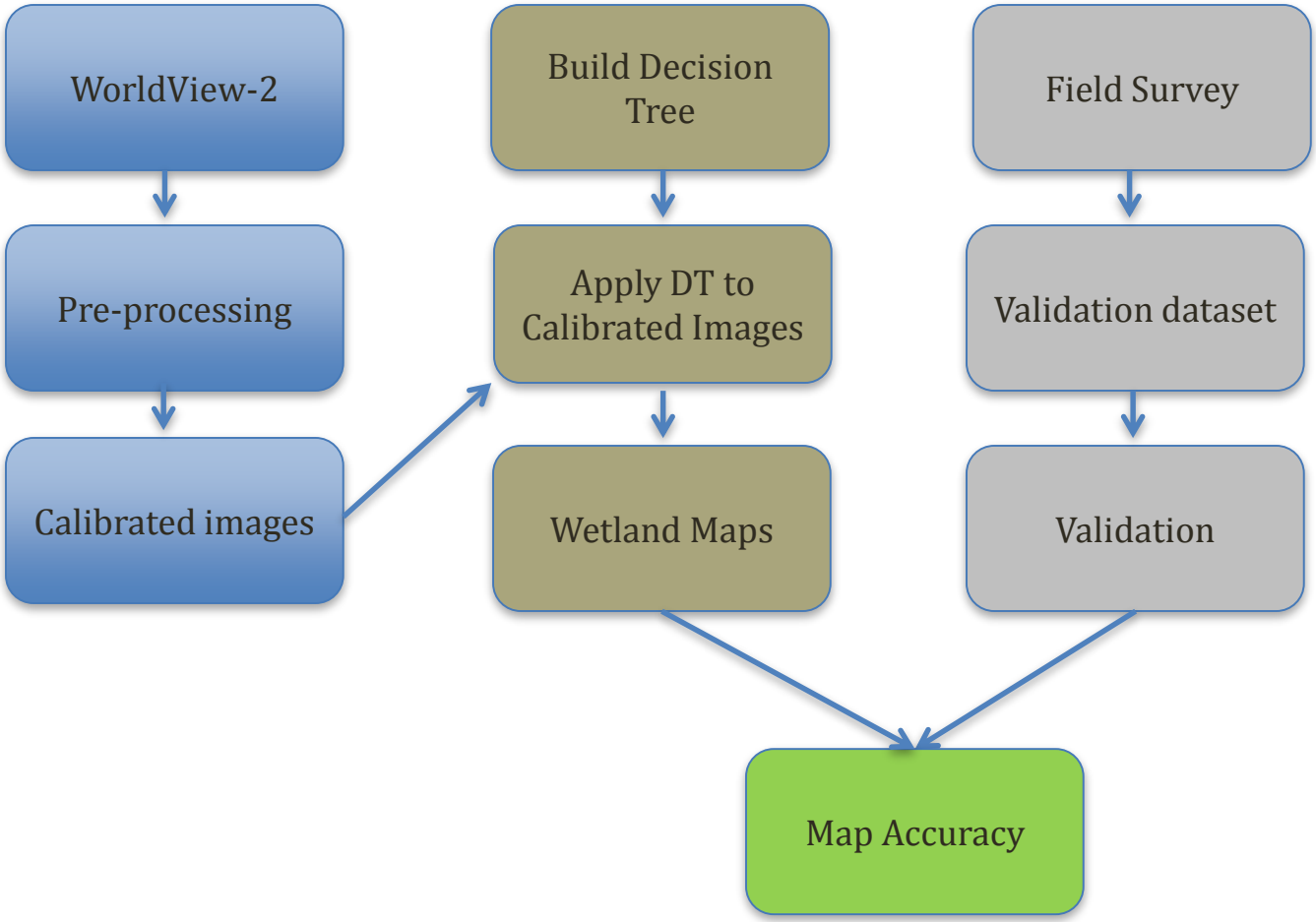


WorldView-2:
2 meter resolution

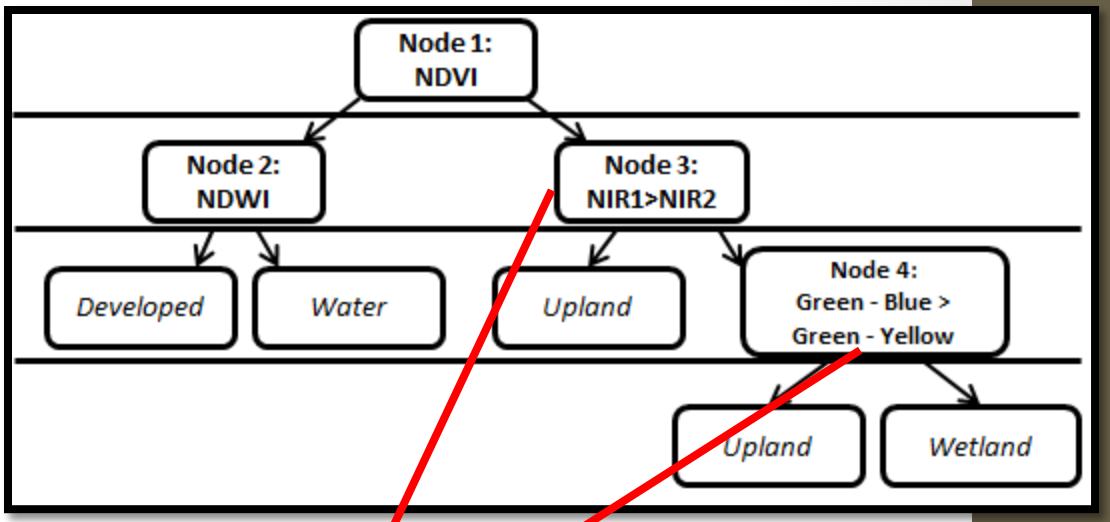
Study Areas


Tampa
6
Clearwater
Old Tampa Bay
Weedon Island
Largo
Interbay Peninsula
Hillsborough Bay
Saint Petersburg
Tampa Bay
Boca Ciega Bay
Fort De Soto

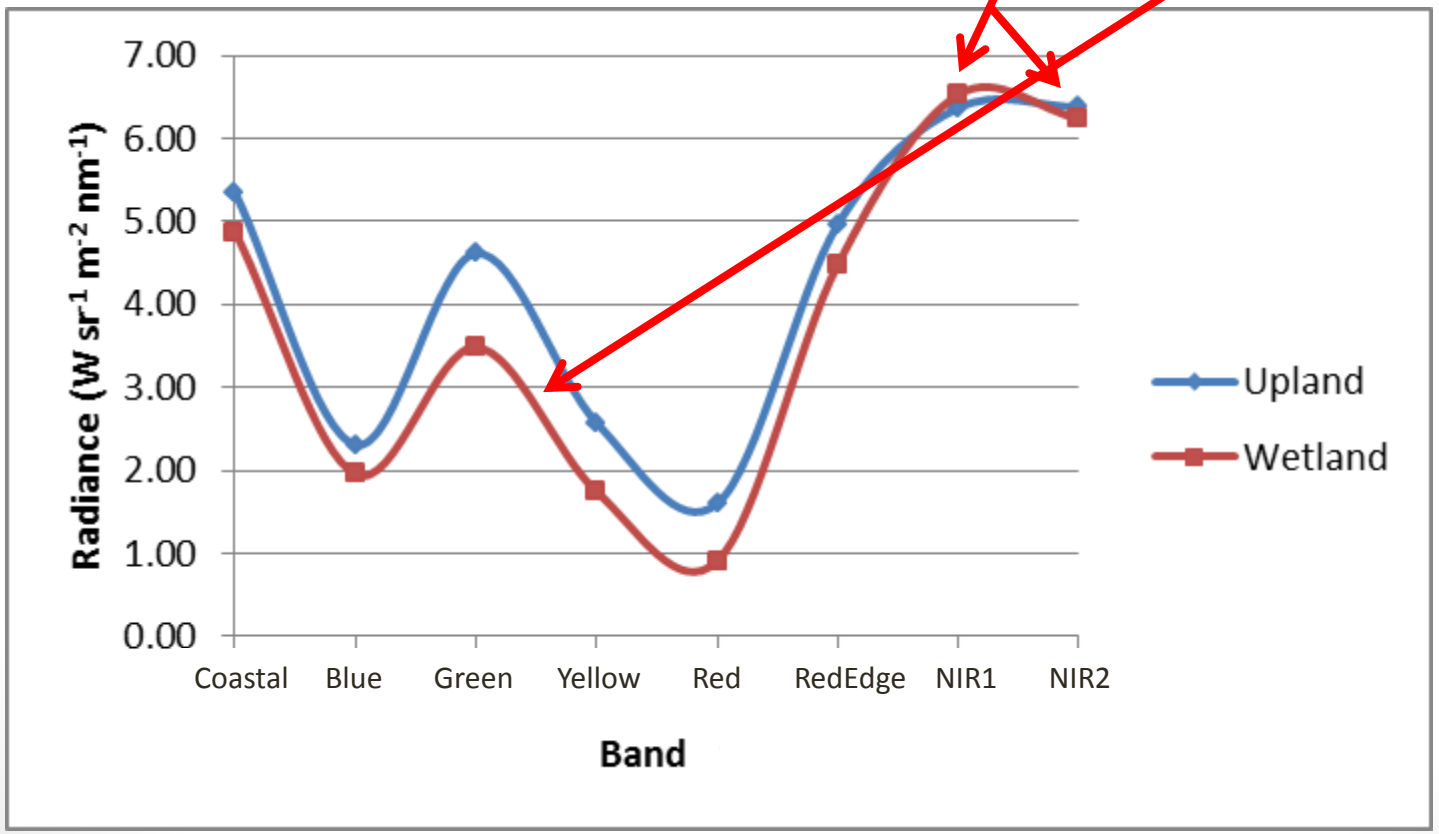
Methodology



Decision Tree



1,500 Spectral Profiles



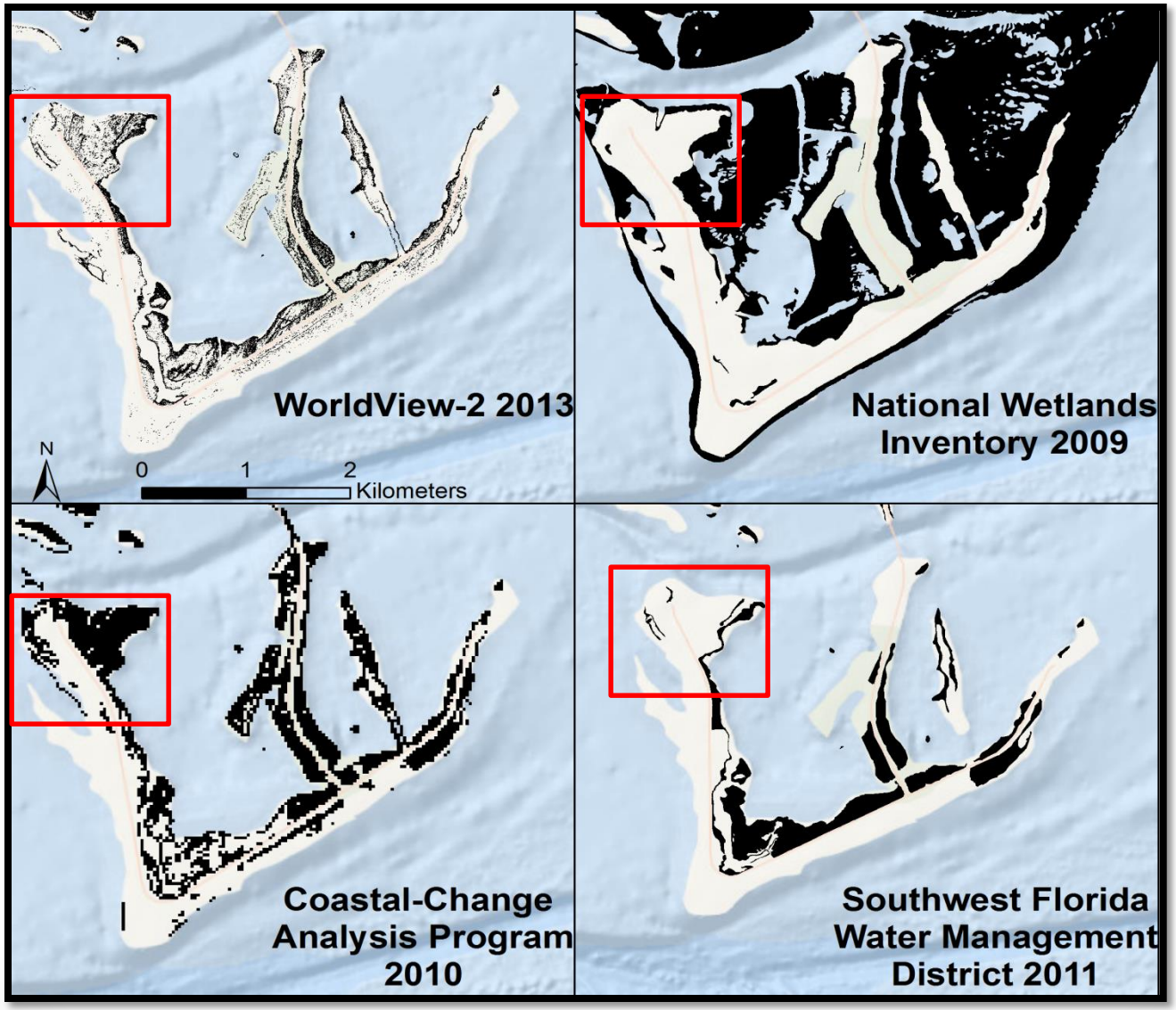
Results: Map Accuracy

	Overall Accuracy	Forested Wetland Accuracy	Forested Wetland Errors
NOAA C-CAP	84%	N/A	90%
WorldView-2 (Fort de Soto)	**90%**	**82%**	**10%**
WorldView-2 (Weedon Island)	**85%**	**94%**	**22%**

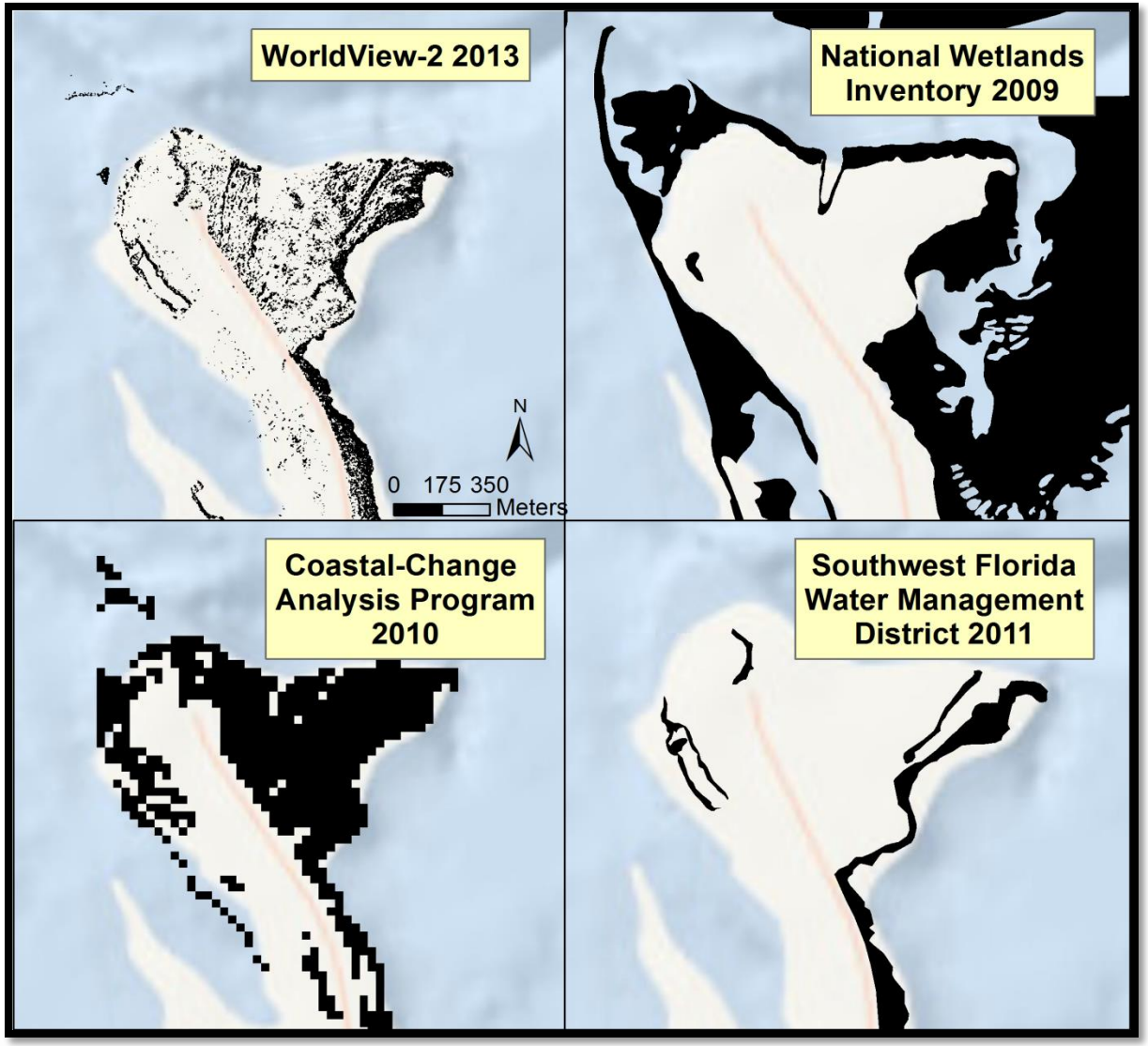
Results: Map Precision

	Fort De Soto		Weedon Island	
Map Source	Wetland Area (km^2)	Factor Difference	Wetland Area (km^2)	Factor Difference
WorldView-2	0.94	N/A	6.17	N/A
SWFWMD	2.49	2.64	8.19	1.33
C-CAP	4.99	5.31	12.74	2.06
NWI	9.92	10.55	12.43	2.01

Results: Map Comparisons



Results: Map Comparisons



Conclusions

- WorldView-2 + Decision Tree efficiently improve wetland accuracy and precision over some current mapped products
- Current wetland maps overestimate wetland area
- Further enhancement of the Decision Tree is needed to improve wetland and upland identification
  - Incorporate non-forested wetlands
  - Identify species-level wetlands

References

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- Ozesmi, S. L., & Bauer, M. E. (2002). Satellite remote sensing of Wetlands. *Wetlands Ecology and Management* , 381-402.
- Raabe, E., Roy, L. & McIvor, C. (2012). Tampa Bay Coastal Wetlands. Nineteenth to Twentieth Century Tidal Marsh-to-Mangrove Conversion. *Estuaries and Coasts, 35 (5),* 1145-1163.

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