Mapping Vegetation Canopy Structure and Distribution for the Tennessee Side of Great Smoky Mountains National Park Using LiDAR

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Introduction

Objective: Utilize high resolution LiDAR to map vegetation canopy structure and distribution for Great Smoky Mountains National Park

- Process and analyze multiple-return LiDAR
- Investigate vertical canopy structure and its distribution
- Correlation between vertical canopy structure and vegetation?
- Validate using existing vegetation maps
- Can LiDAR-based canopy structure improve vegetation mapping and monitoring efforts?

Data sets used in the project

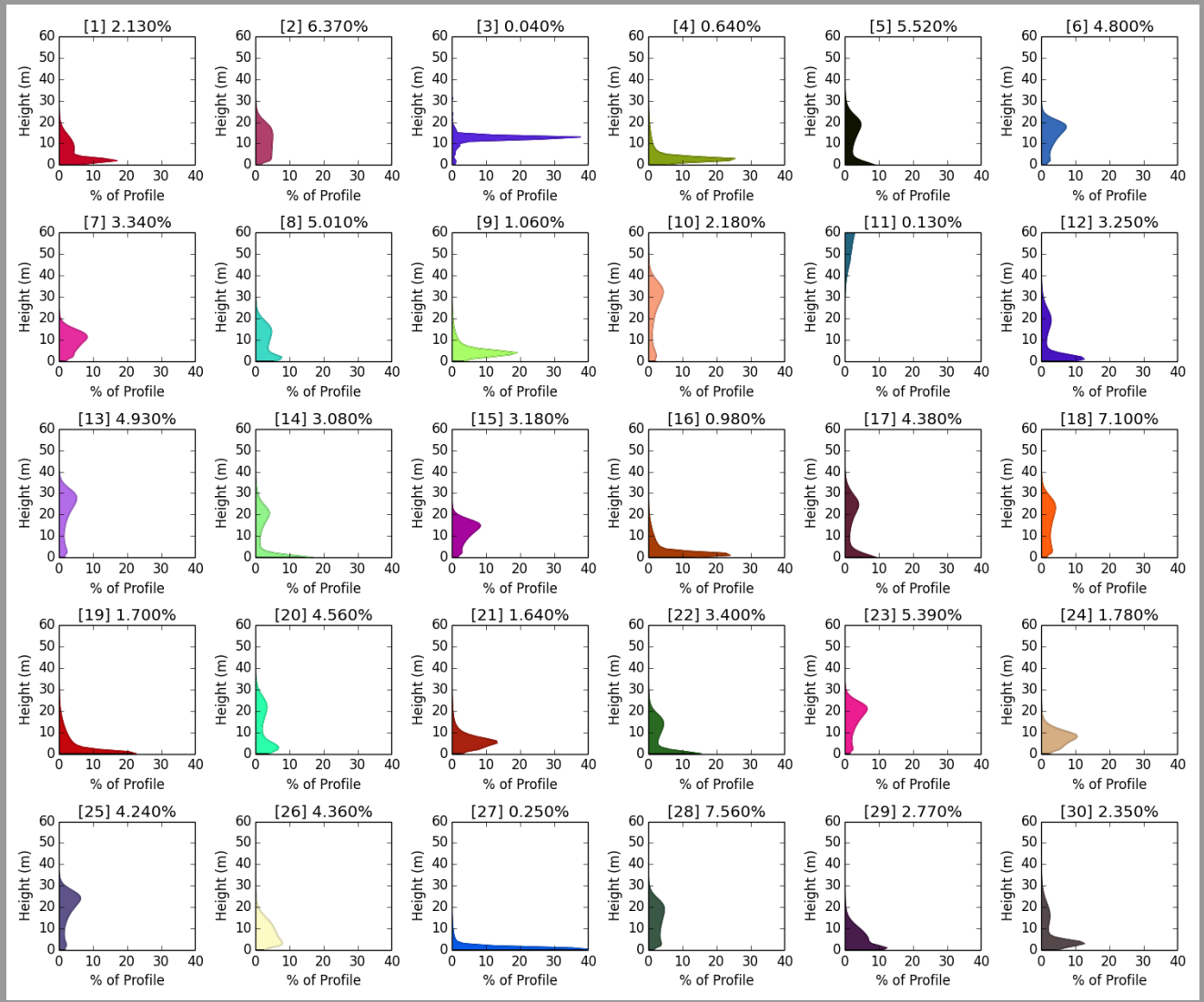
High resolution LiDAR point cloud data sets were obtained from the National Park Service and the US Forest Service

- 724 tiles (LAS files), total of 94 GB
- Each LAS file contained approximately 2-6 million points
- Python workflow in embarrassingly parallel fashion

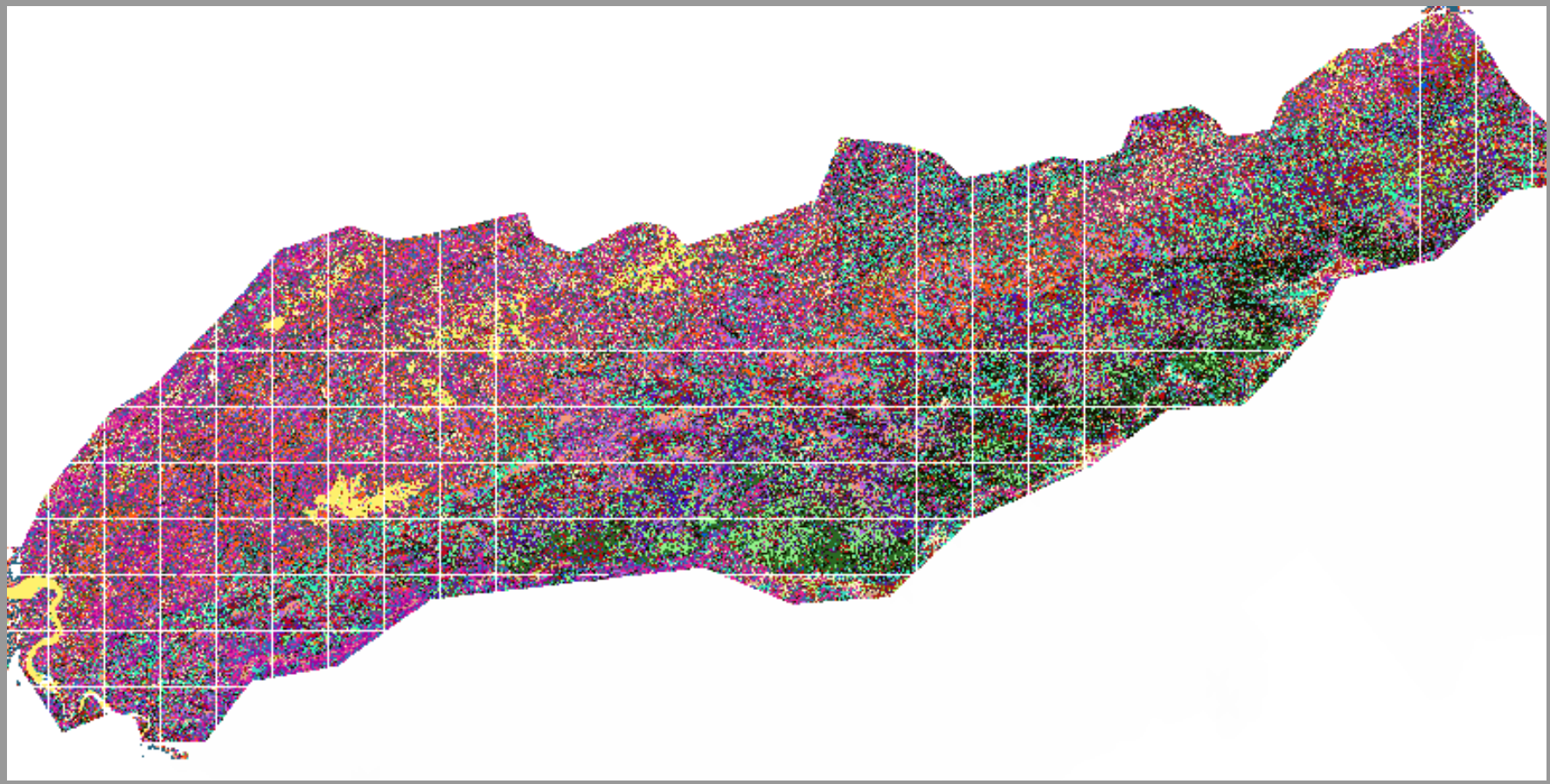
Methods

- Correction (datum to ground surface) was made using a high resolution digital elevation map
- Used 30m x 30m resolution to match LANDSAT and NLCD resolutions
- Vertical structure profiles of vegetation were developed
- Profiles were classified using *k*-means clustrering algorithm
- Maps of canopy structure distribution were checked with vegetation maps

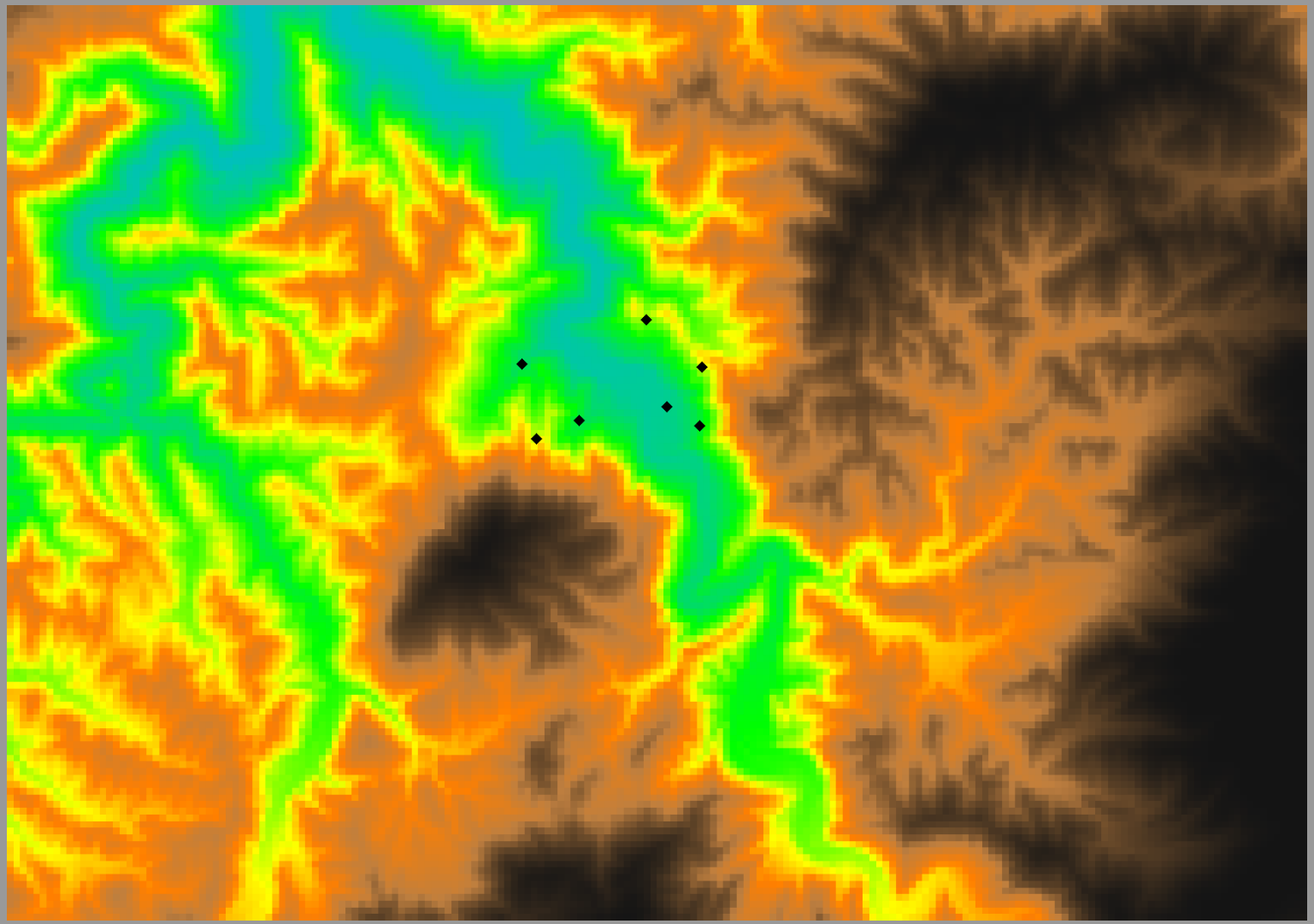
30 canopy structures with percent map coverage



Spatial distribution of 30 categories



Phenology plots maintained bv Great Smoky Mountains Institute at Tremont (GSMIT)



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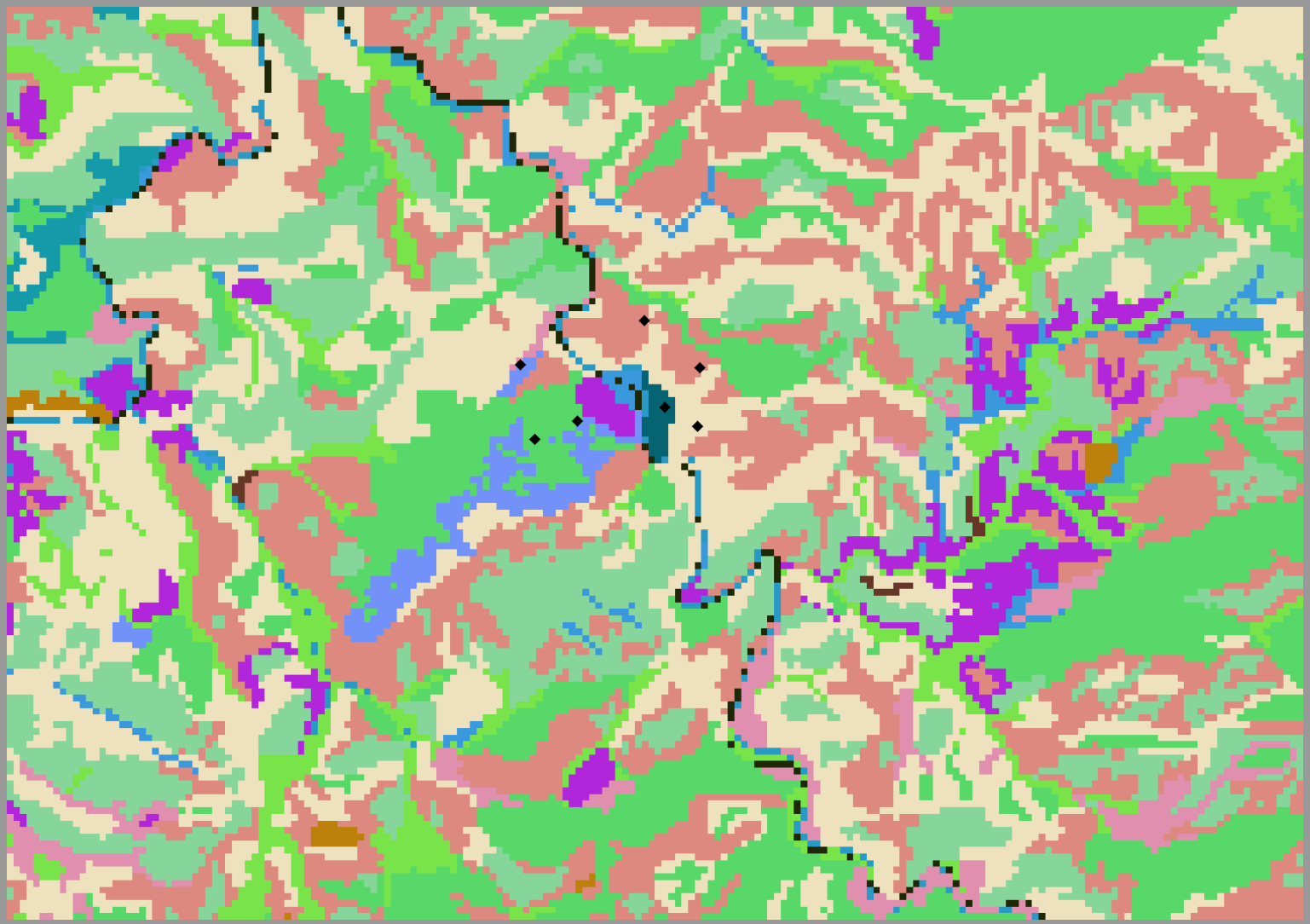

Figure: Overstory Vegetation at Great Smoky Mountains National Park, Tennessee and North Carolina, provided by NPS, Author: Dr. Marguerite Madden

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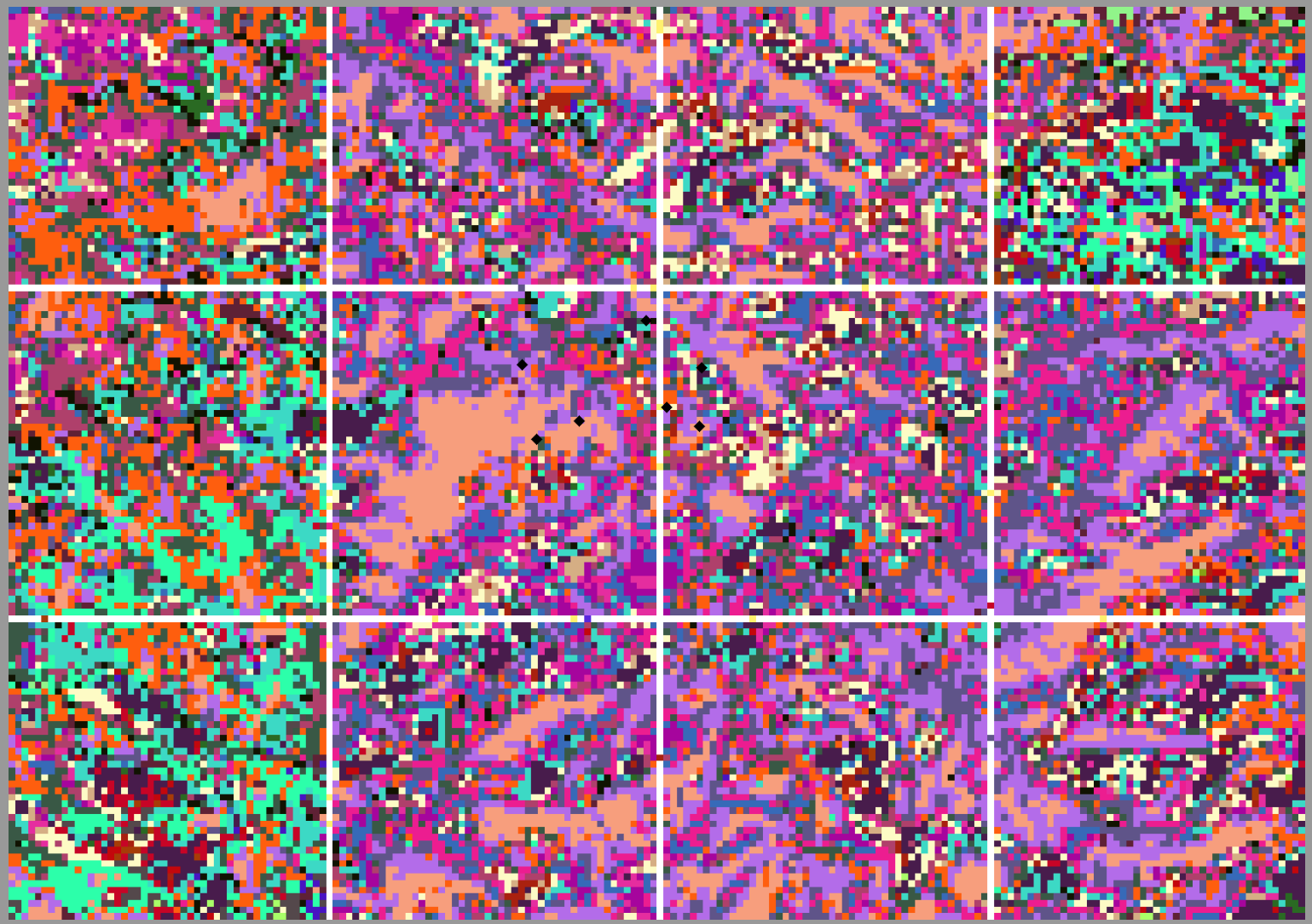
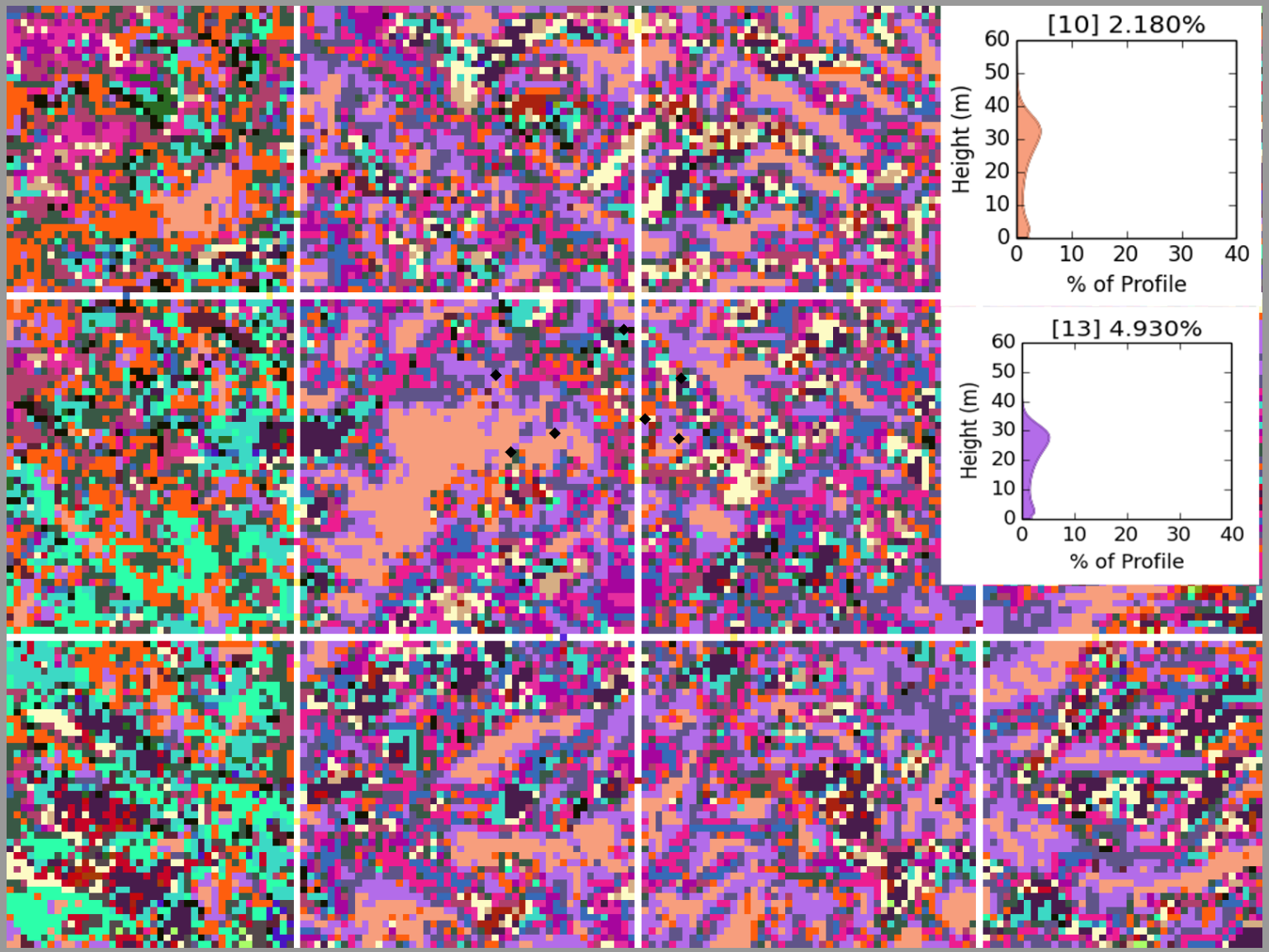


Vegetation at GSMIT sites: Montane Cove Forest



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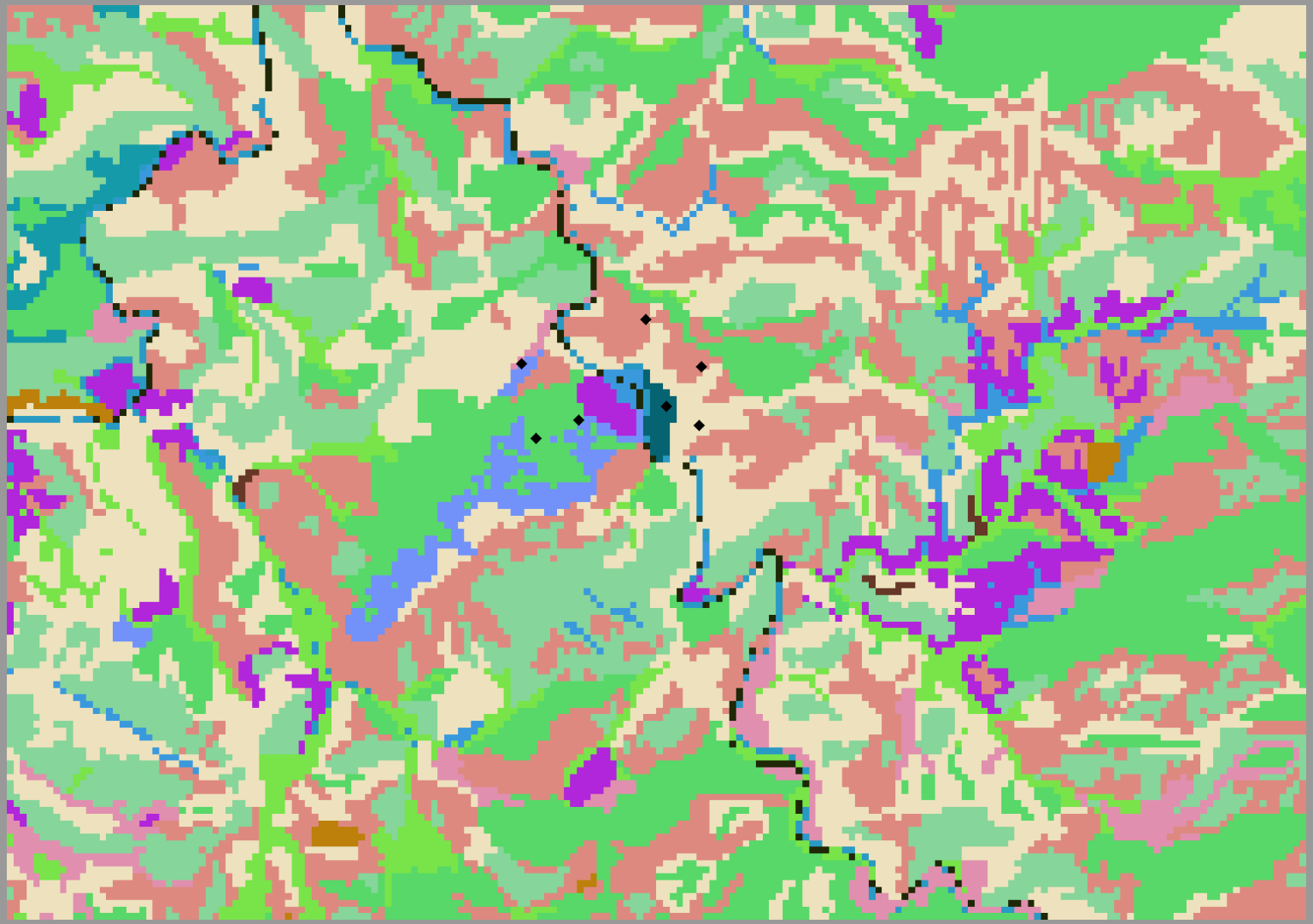

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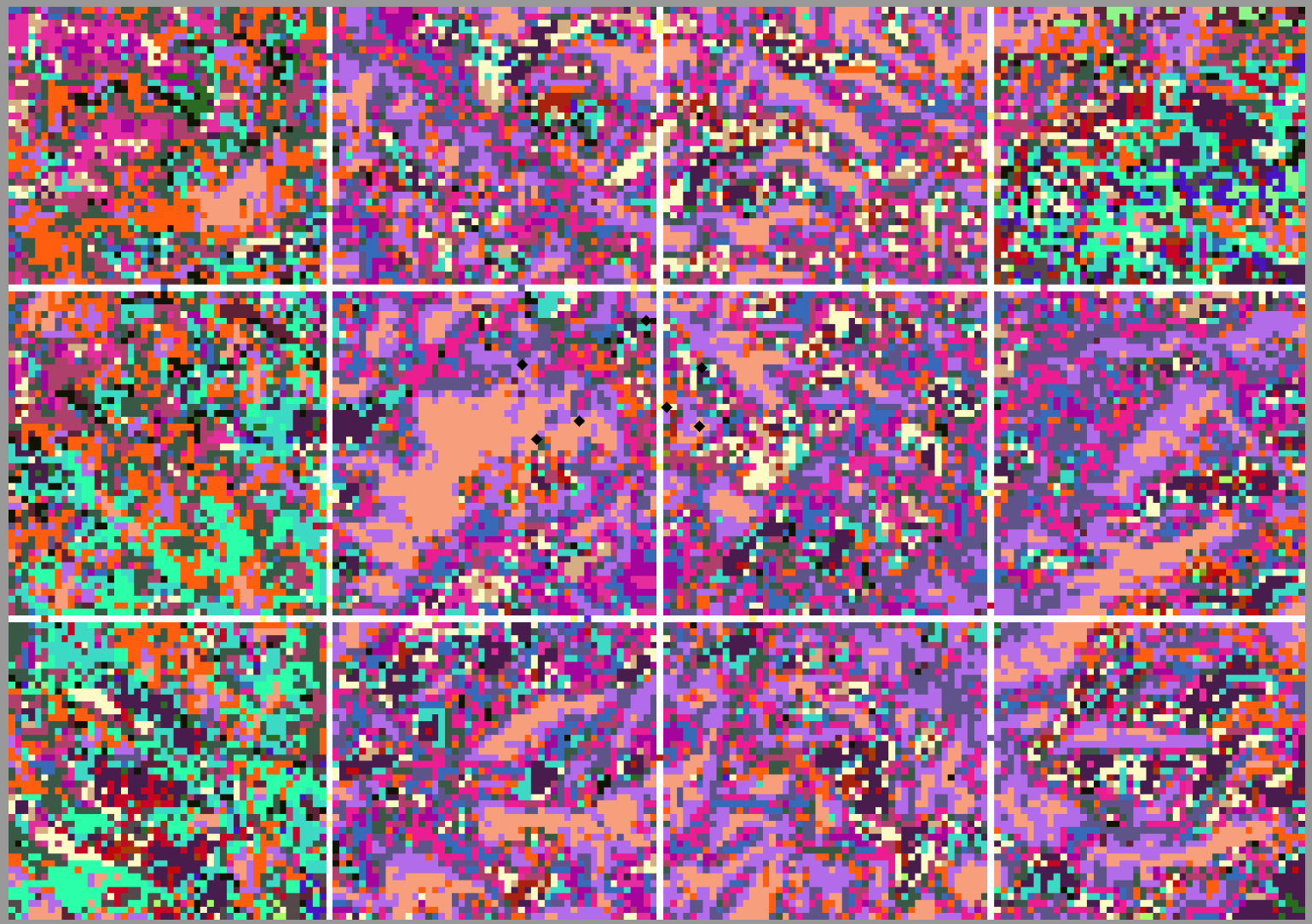

Discussion

- Initial results show good correlation between canopy structure and vegetation
- Need further tests to establish sufficient correspondence
- Expand to NC side of GSMNP
- Could guide future high resolution vegetation mapping efforts

Summary

- Processed and analyzed large volume of LiDAR data for GSMNP
- Generated vertical canopy structure profiles at 30m resolution
- Tests at Tremont sites show good match between profiles and vegetation
- Validate with field observations and more tests
- Future use: remotely determine vegetation type with high-resolution LiDAR

Work from this project would be presented at AGU Fall Meeting 2015