Evaluating Landscapes with Small Unmanned Aerial Vehicles

Paul Kolp & Matthew Schwartz

Lower Columbia Estuary Partnership

Evaluating Landscapes with Small Unmanned Aerial Vehicles

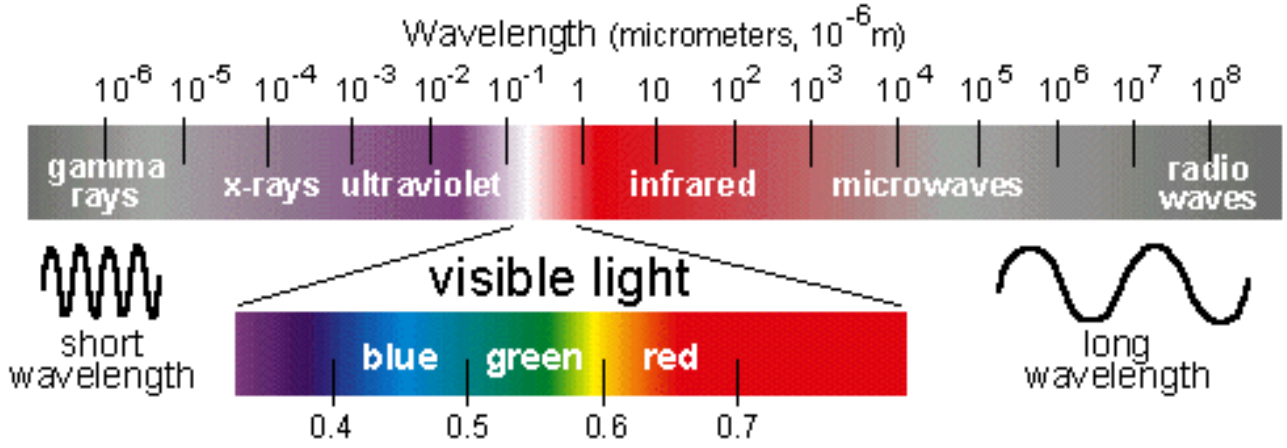
- Small Unmanned Aerial Vehicle's (sUAV) have the potential to become a useful tool to monitor sites in the same or less time than current methods
- Topography and vegetation are metrics that can be captured with sUAV
- Monitoring physical and environmental metrics can be used to accurately estimate impacts of restoration actions

Tools You Will Need

- Digital camera in the sky (many ways)
- Sensor/camera in the sky (many sensors- RGB, near infrared, hyperspectral, etc.)
- Photogrammetry software
- ArcGIS
- Statistical software
- Survey equipment (survey grade is nice)
- A friendly botanist

Assessing Vegetation with Small Unmanned Aerial Vehicles (sUAV)

- For vegetation an index can be constructed to classify vegetation types/assemblages based on spectral signatures
  - Indexes can be built using visible light, spectral, and hyperspectral wavelengths:
    - Visible light indexes include: Visible Atmospherically Resistant Index (VARI), Normalized Green Red Difference Index and Green Leaf Index
    - Spectral indexes include: Normalized Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI)



Near infrared is within visible- infrared bands

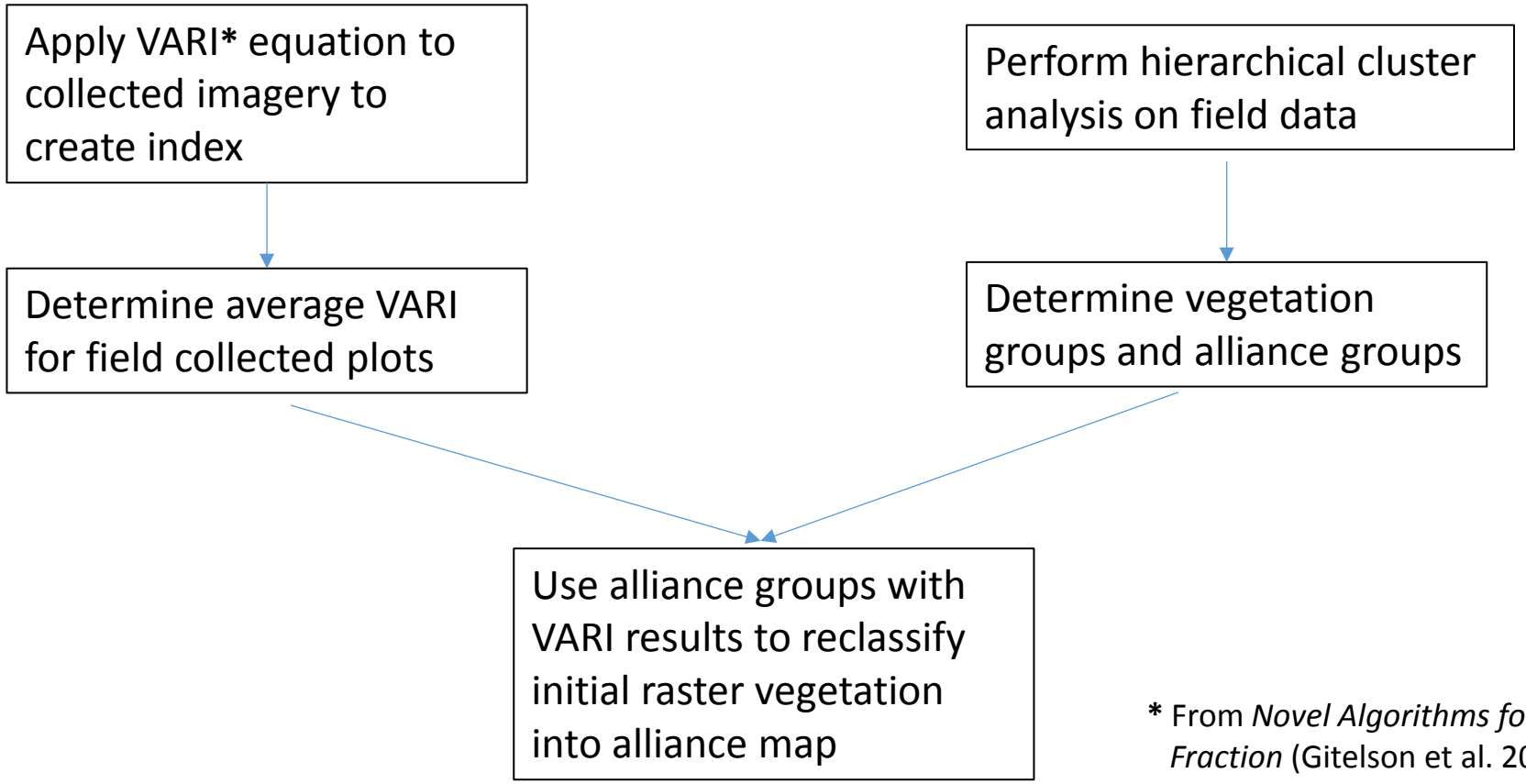
Vegetation Monitoring

Sauvie Island North Unit Phase 1 (Ruby Lake)

- Site extent ~ 170 acres
- Vegetation Monitoring ~ 2 acres

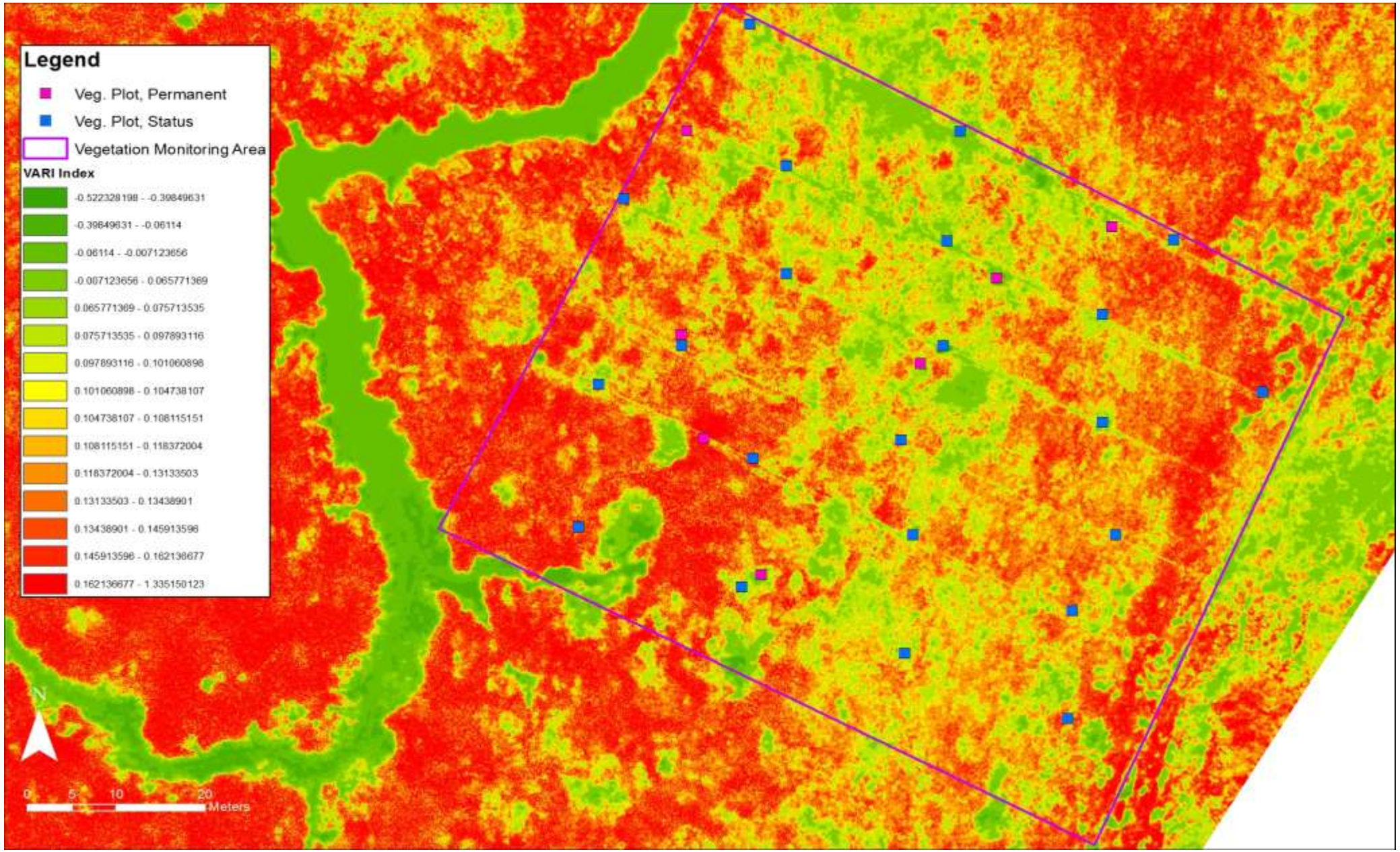
Visible Atmospherically Resistant Index (VARI) for Vegetation Characterization

- Analysis Methodology: *Mapping changes in tidal wetland vegetation composition and pattern across a salinity gradient using high spatial resolution imagery* (Tuxen et al. 2010)

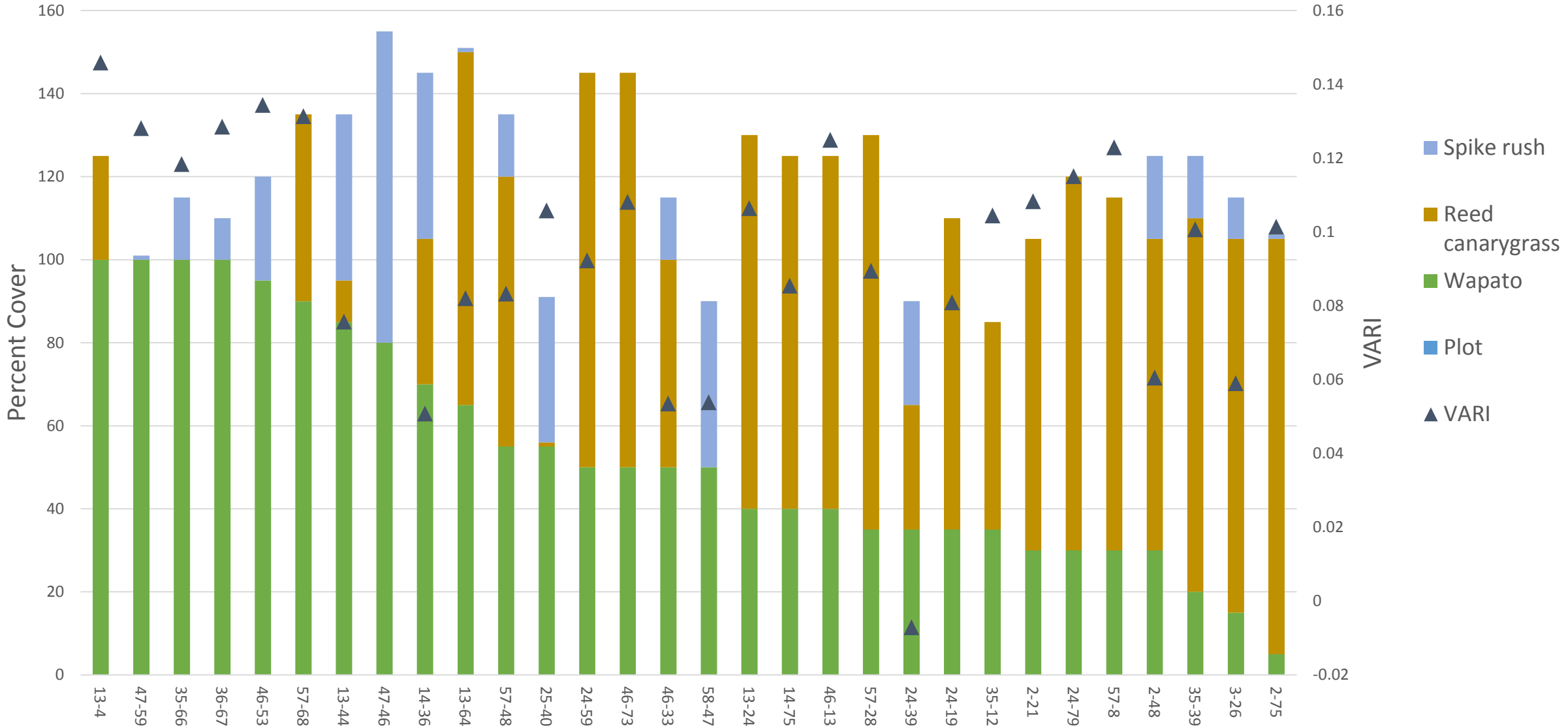


* From *Novel Algorithms for Remote Estimation of Vegetation Fraction* (Gitelson et al. 2002)

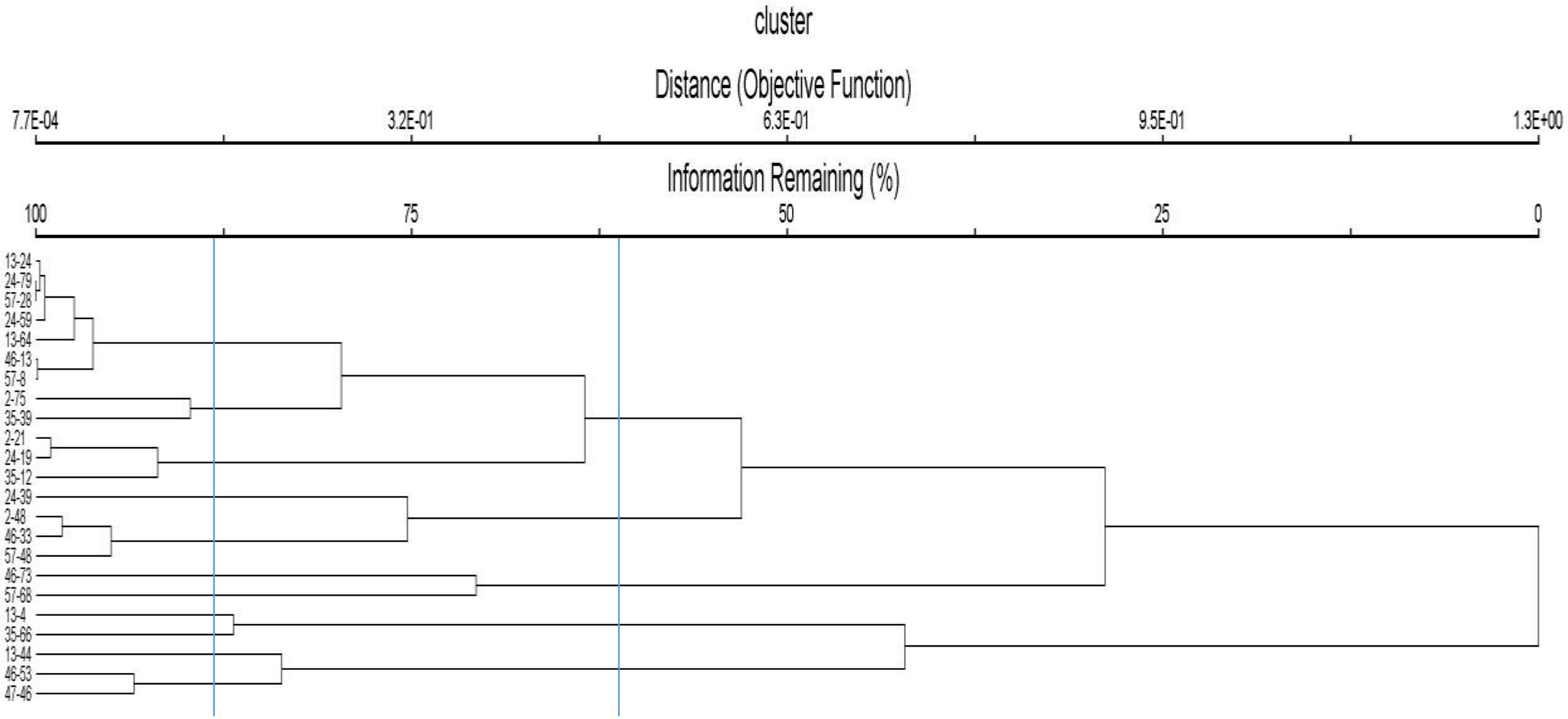
Initial VARI Index



VARI with Dominant Vegetation Found in Plot



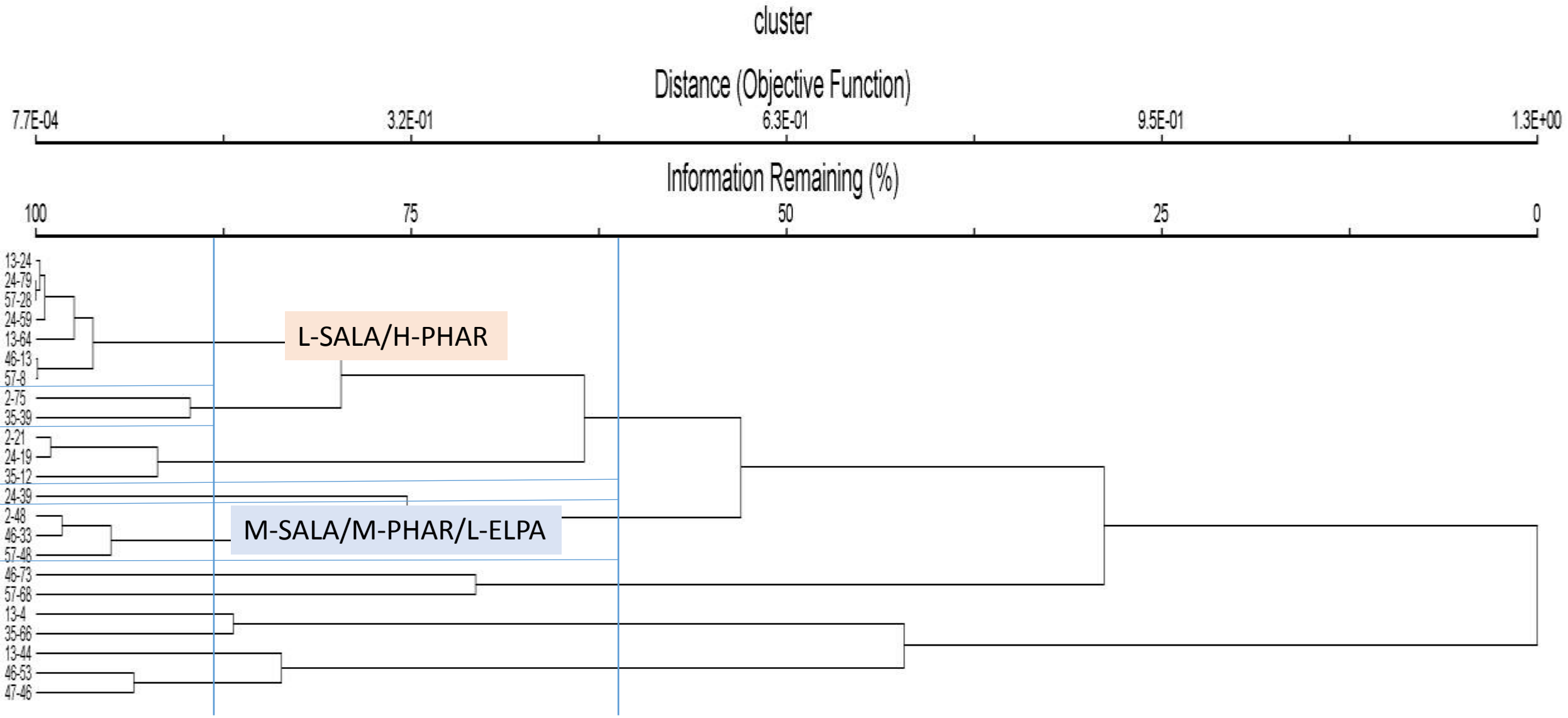
Cluster Analysis



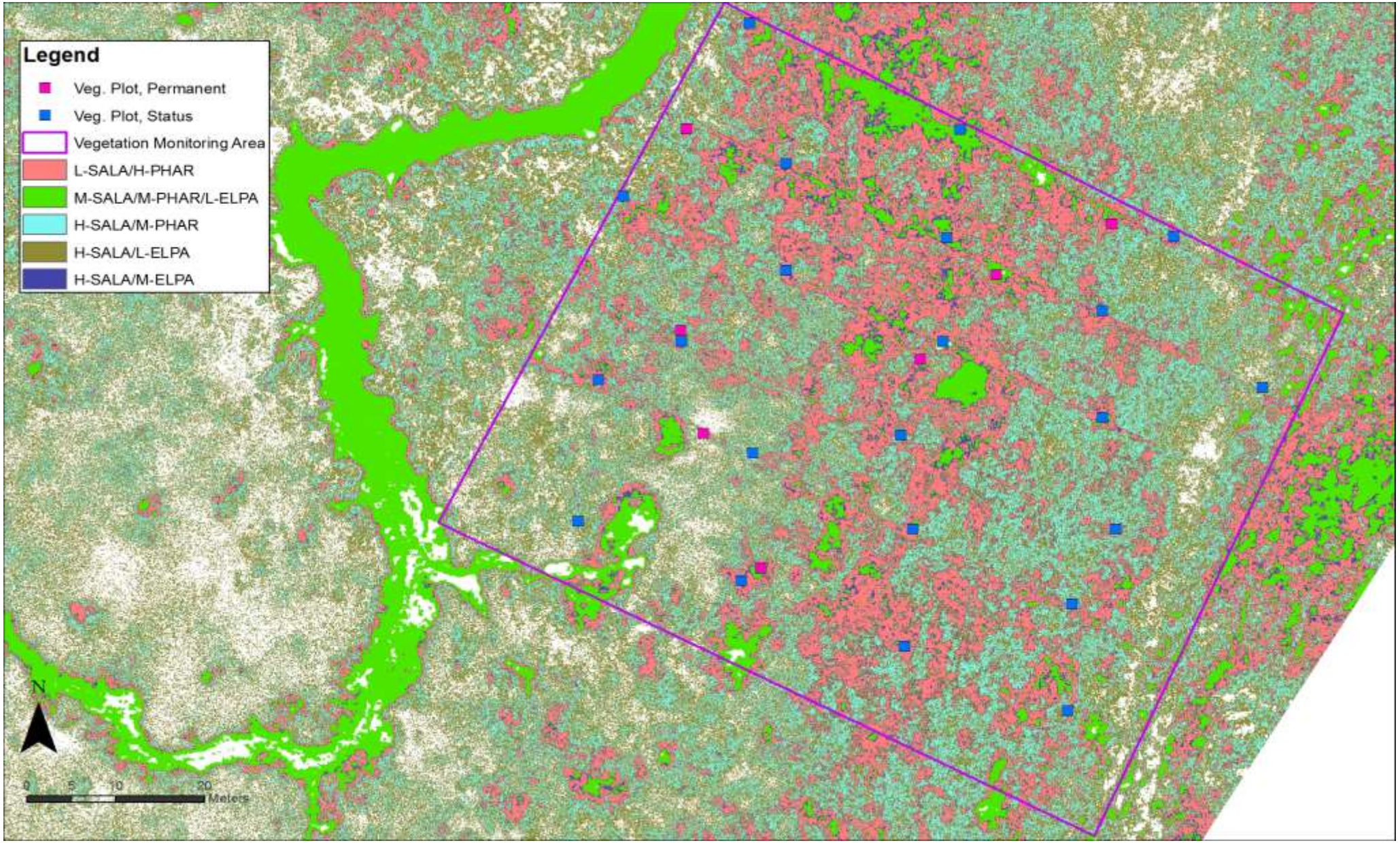
Vegetation Group

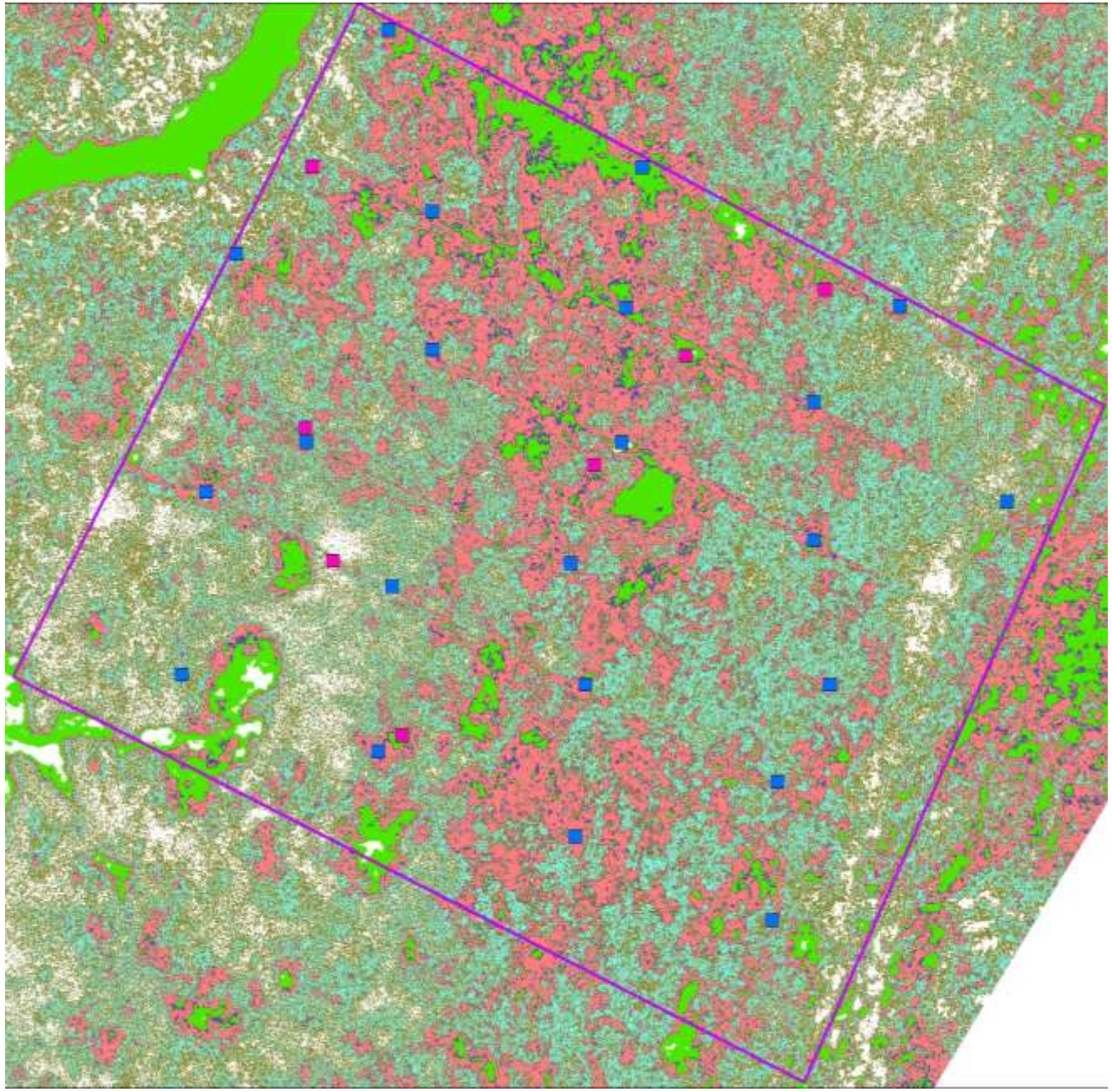
Vegetation Alliance

Cluster Analysis



Reclassified VARI Index





Results Visible Atmospherically Resistant Index (VARI) for Vegetation Characterization

Subset of seven vegetation plots used to validate accuracy (pink squares):

- 3 plots were exact match with vegetation alliance
- 3 plots were partial match with vegetation alliance
- 1 plot was a poor match with vegetation alliance

Lessons Learned & Future Directions

- We were able to accurately characterize vegetation using the visible light index
- Images should be captured under similar light conditions across the site
- There should be plots throughout the sampling area
- Having knowledge of the site before the “analysis” is important
- The addition of near infrared spectrum should improve ability to characterize vegetation