Rangeland Brush Estimation Toolbox (RaBET)
A New Aid for Rangeland Mangers

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BRUSH MANAGEMENT IN NRCS

- Brush management is one of the most cost-shared and implemented conservation practices on grazing lands.
- 2012-2014 NRCS spent over $18.6 million nationwide.
  - Slightly over $11.1 million was spent in Texas.
- Little to no documentation that would support or refute the need for Brush Management in the conservation planning process.
- Need a more efficient, repeatable way to determine woody canopy cover baseline and change data for documentation in the planning process.

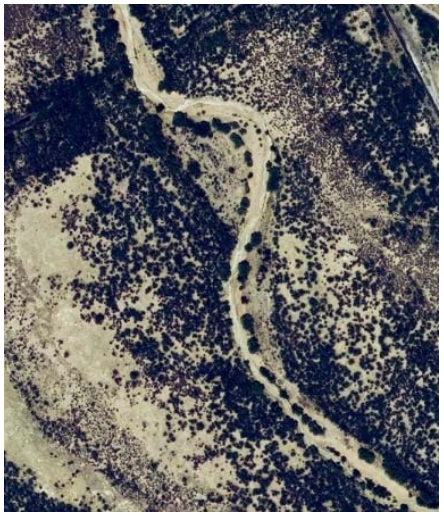
Rangeland Brush Estimation Toolbox (RaBET)

- An ArcGIS toolbox for generating large-scale maps of woody cover and performing analysis in western grazing lands.

- Key requirements:
  - Use free, publicly available imagery
  - Spatial coverage at the Major Land Resource Area (MLRA) scale
  - Temporal coverage spanning a decade or longer
  - Easy operation with few required user inputs
  - Automation to retrieve imagery as it becomes available

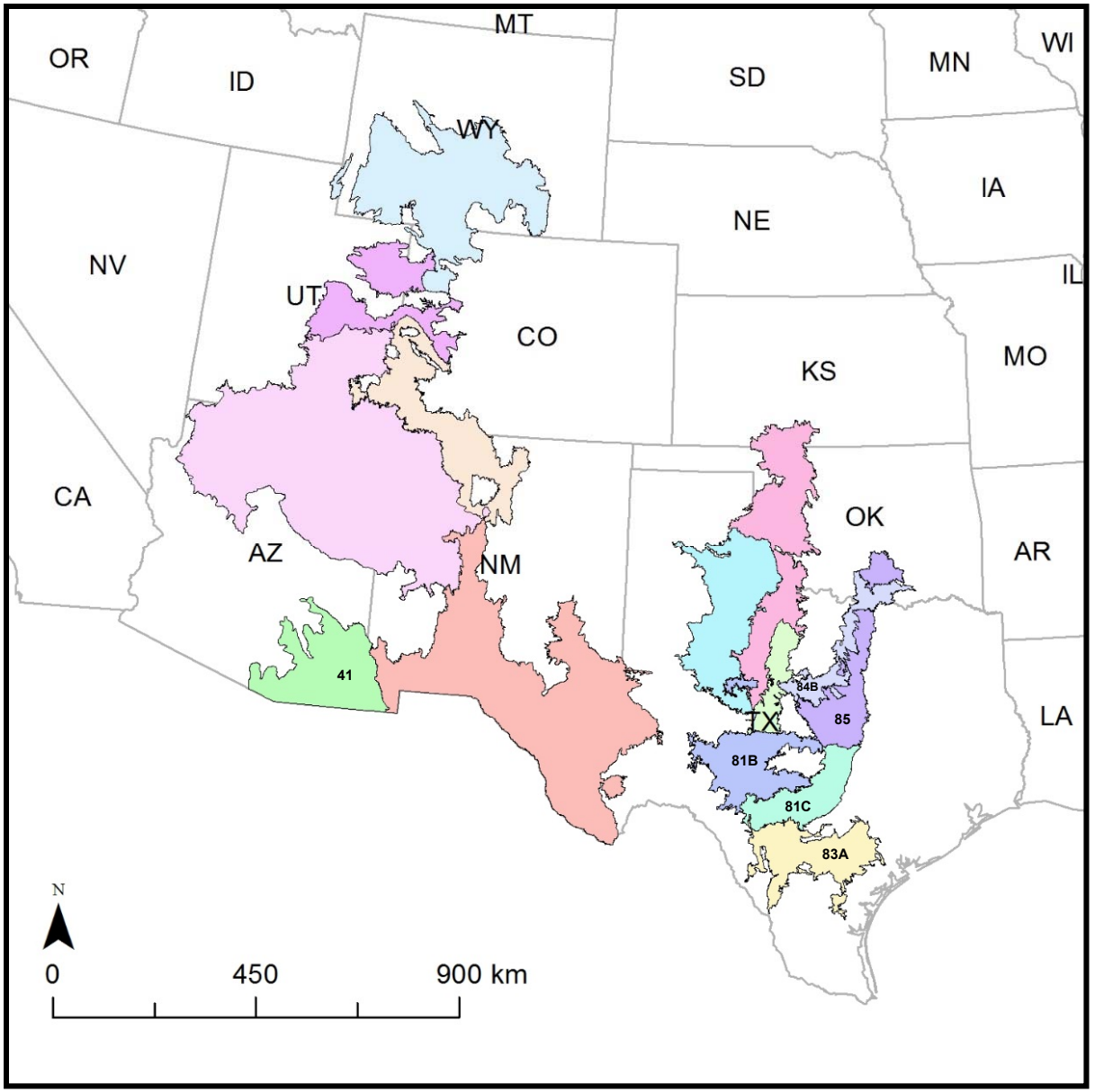
IMAGE PLATFORMS

- **Landsat-TM and Operational Land Imager (OLI) Imagery**
  - 30m resolution
  - Landsat surface reflectance product scenes were used
  - Data record: 1984-present



- **National Agriculture Imagery Program (NAIP)**
  - 1m resolution
  - Data record: 2003-present (~2 year revisit time)

PROJECT MLRAS



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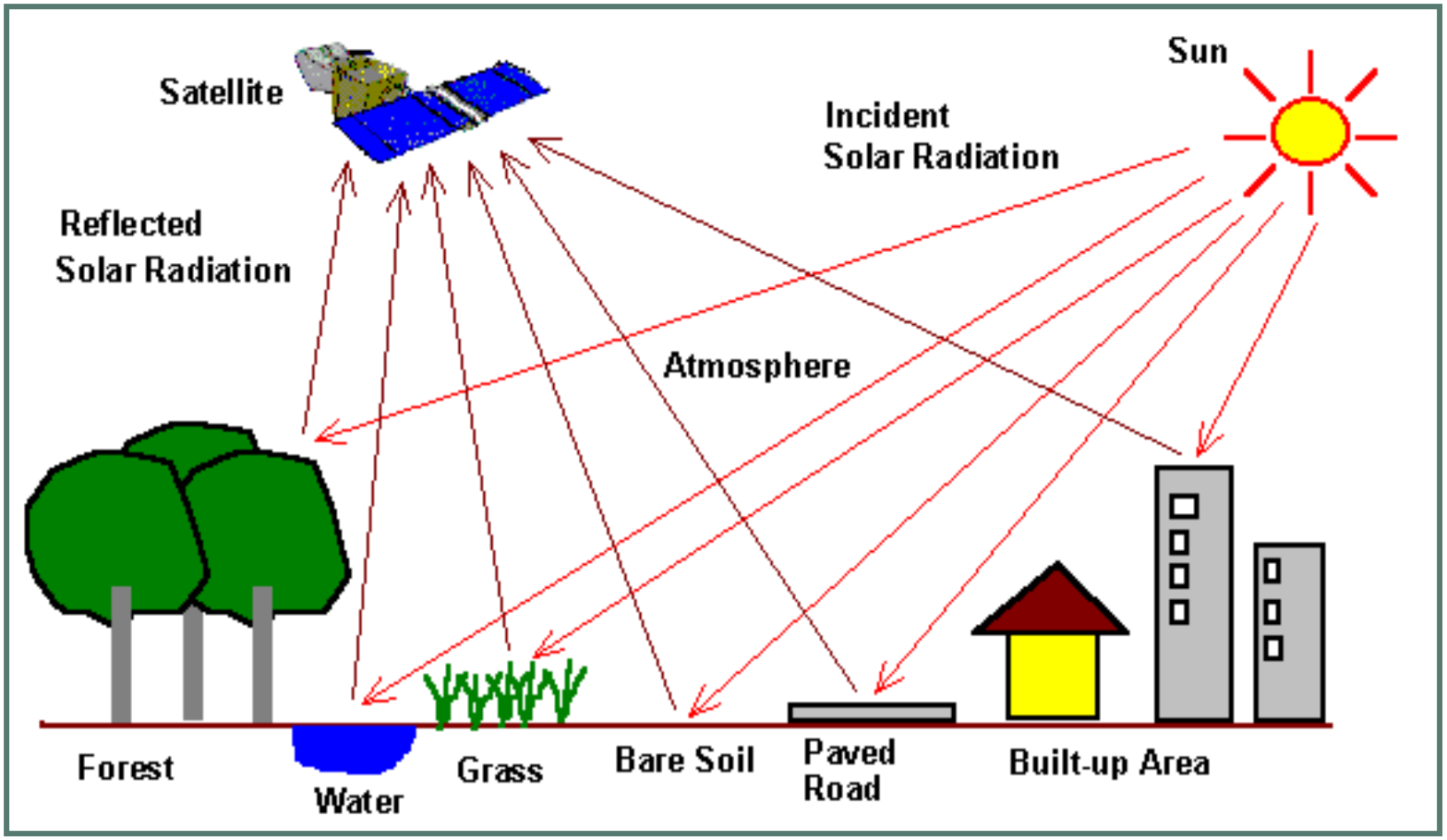
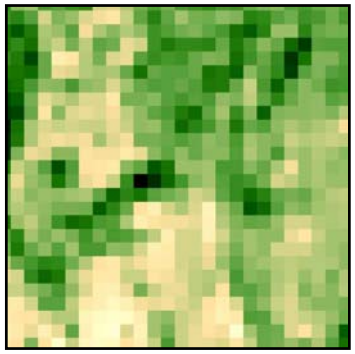
SATELLITE DATA COLLECTION



VEGETATION INDICES

Green Soil Adjusted Total Vegetation Index

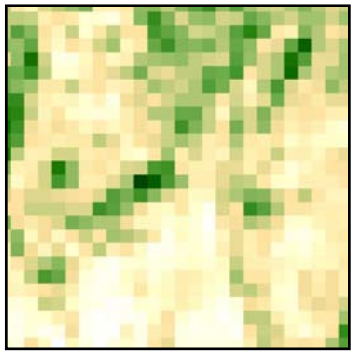
$$GSATVI = \frac{\rho_{NIR} - \rho_{Green}}{\rho_{NIR} + \rho_{Green} + L}(1 + L) - \frac{\rho_{SWIR1}}{2}$$



- GSATVI: improved woody cover estimation

Modified Soil Adjusted Vegetation Index

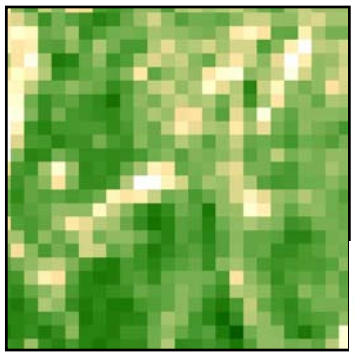
$$MSAVI_2 = \frac{2\rho_{NIR} + 1 - \sqrt{(2\rho_{NIR} + 1)^2 - (\rho_{NIR} - \rho_{Red})}}{2}$$



- $MSAVI_2$: adjusted woody cover estimates influenced by grass background cover

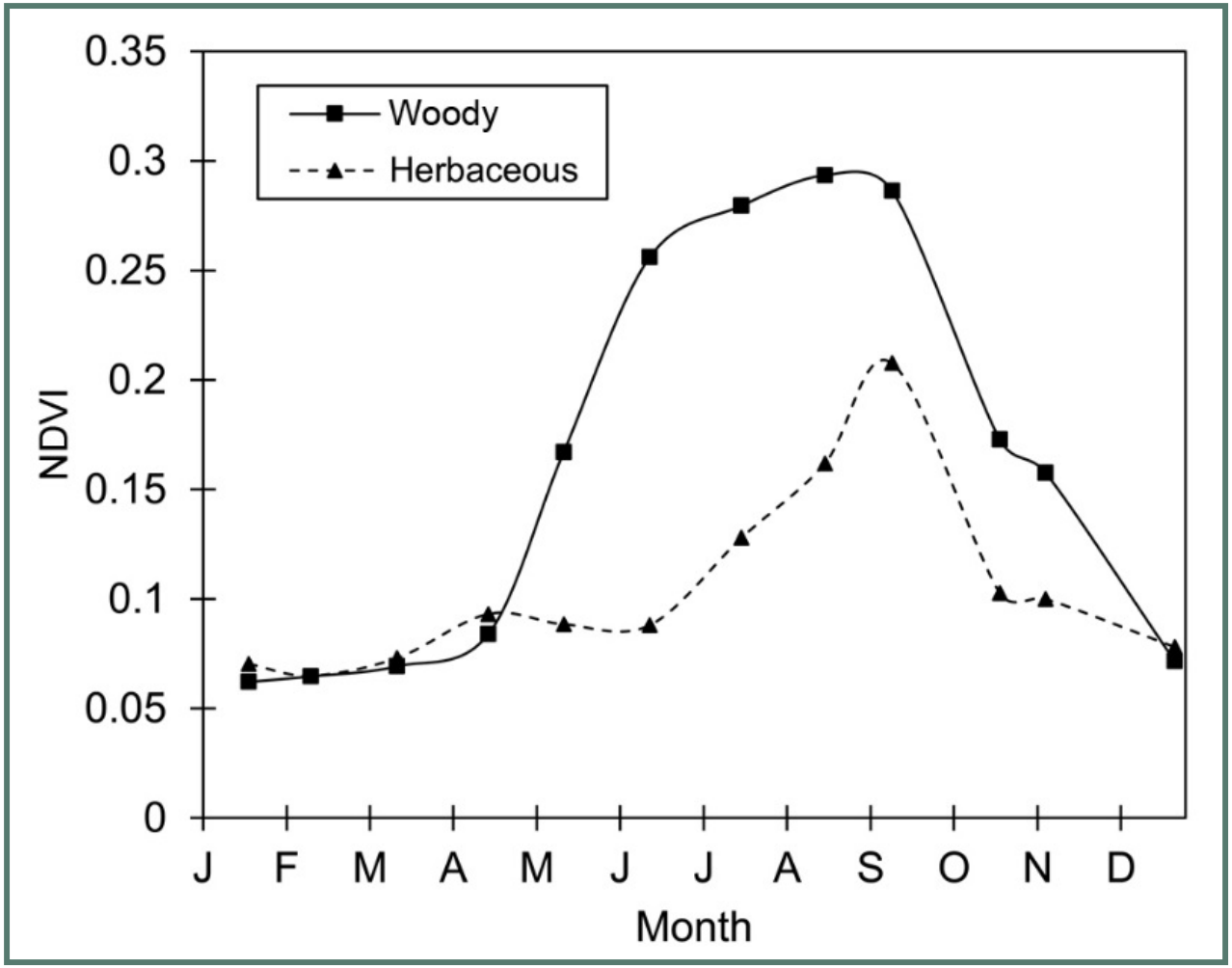
Normalized Difference Index

$$NDI5 = \frac{\rho_{NIR} - \rho_{SWIR1}}{\rho_{NIR} + \rho_{SWIR1}}$$



- NDI5: related to grass background

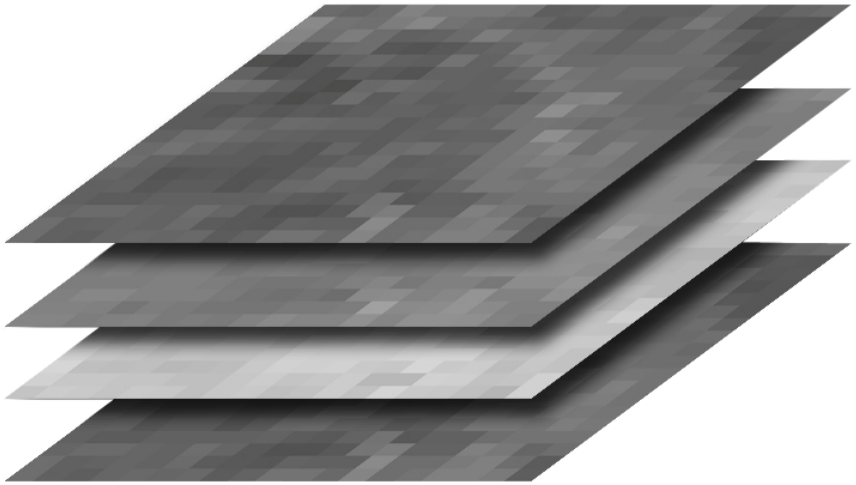
TIMING



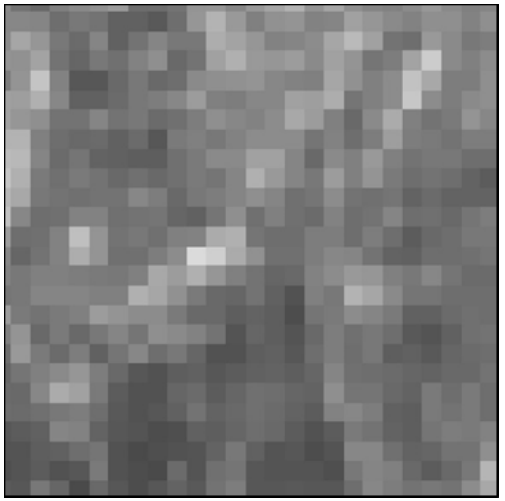
- Time window with greatest separation between woody and herbaceous vegetation: month(s)

PRECIPITATION

- Precipitation influences greenness
  - Variable
- 4-year composites used to dampen effects of high precipitation years

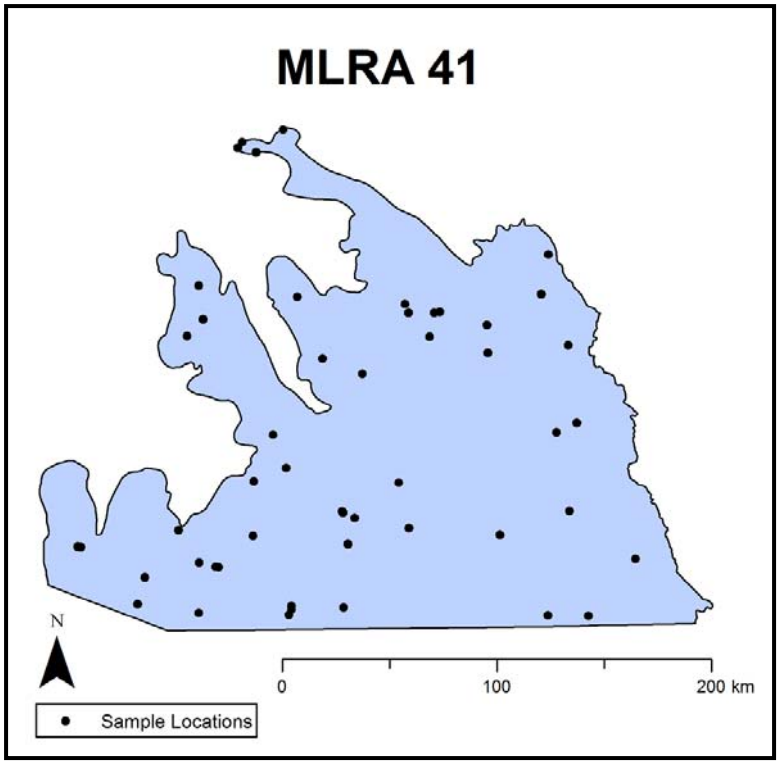


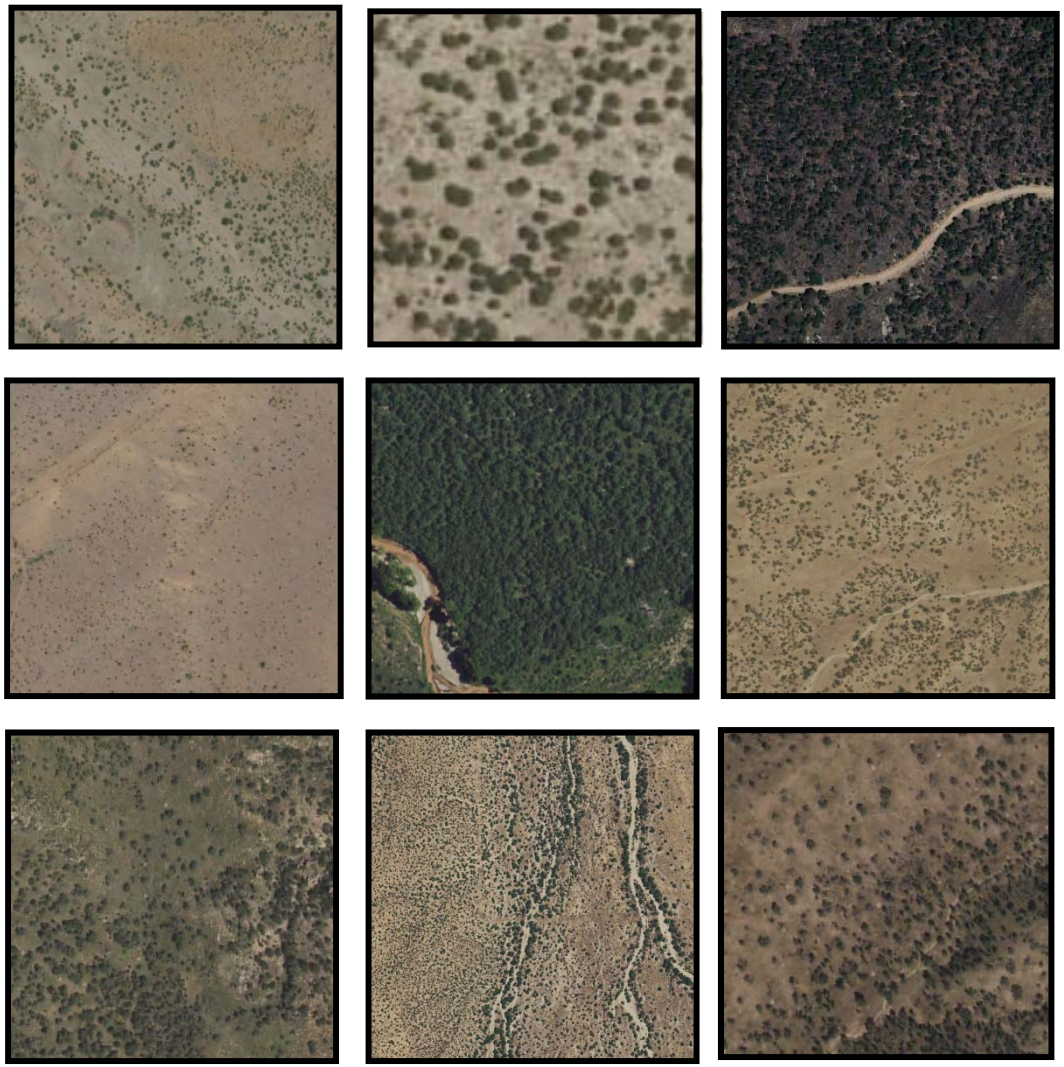
Landsat Image Years



Landsat 4-year Composite

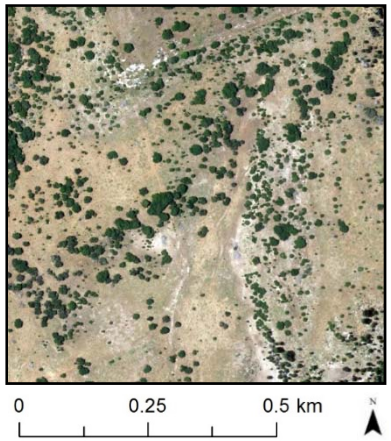
HETEROGENEOUS LANDSCAPE



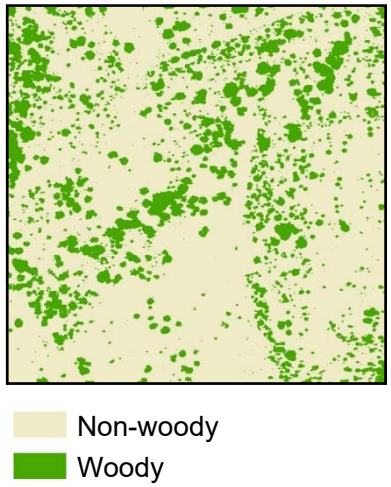


THE MIXED PIXEL PROBLEM

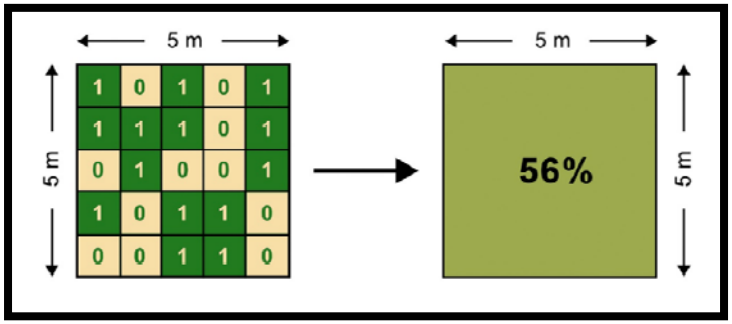
NAIP (1m)



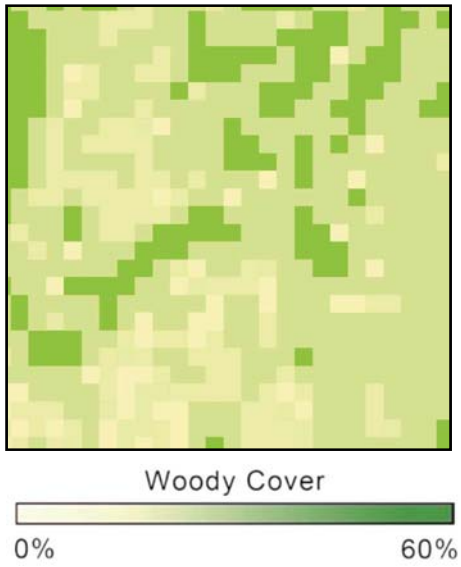
Classified NAIP (1m)



Aggregation



% Woody Cover (30m)



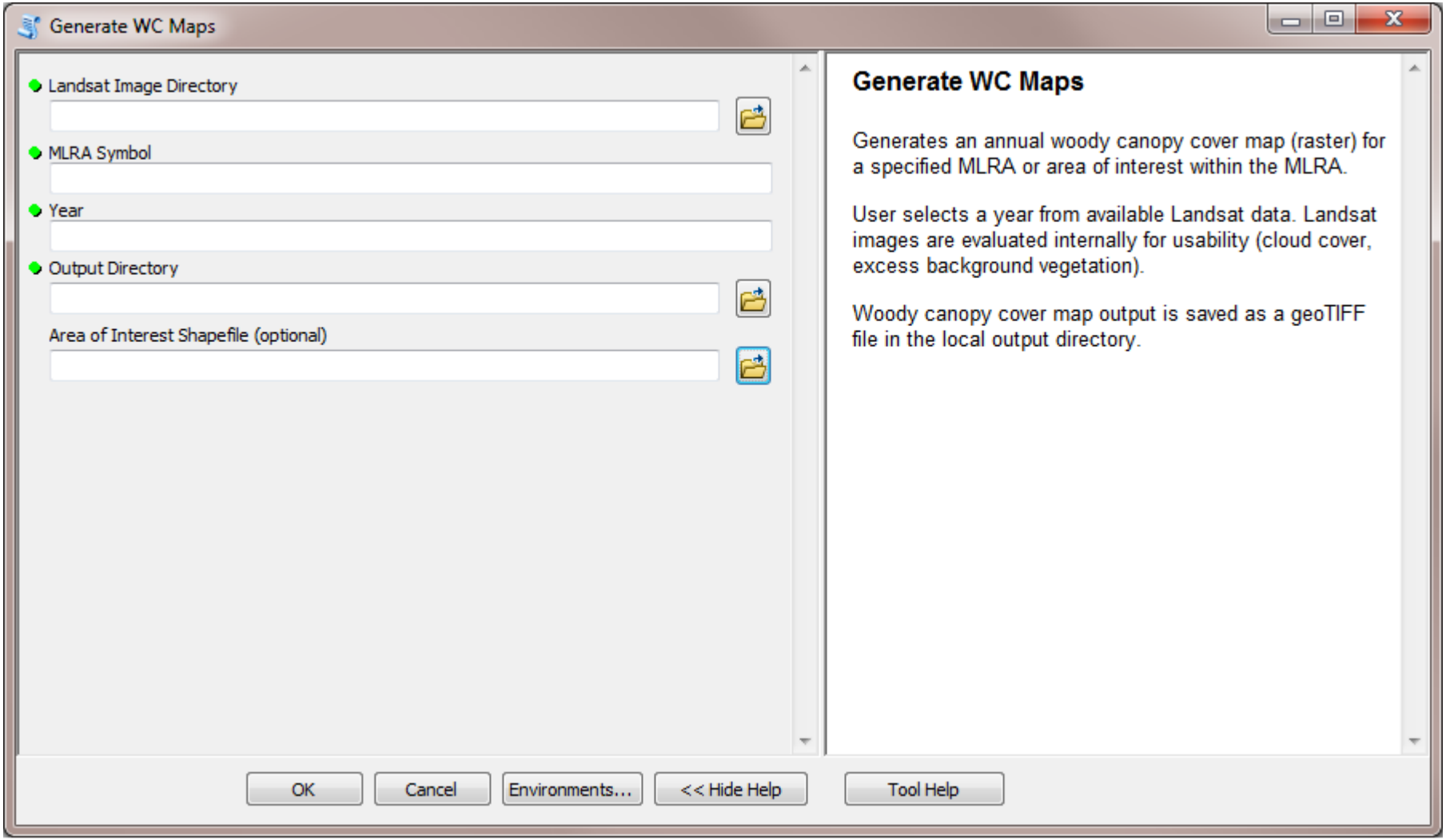
- Multiple linear regression equations were developed between % woody cover and Landsat vegetation indices
- Equations were applied to the 4-year composite Landsat imagery to produce the maps of % woody cover

RaBET

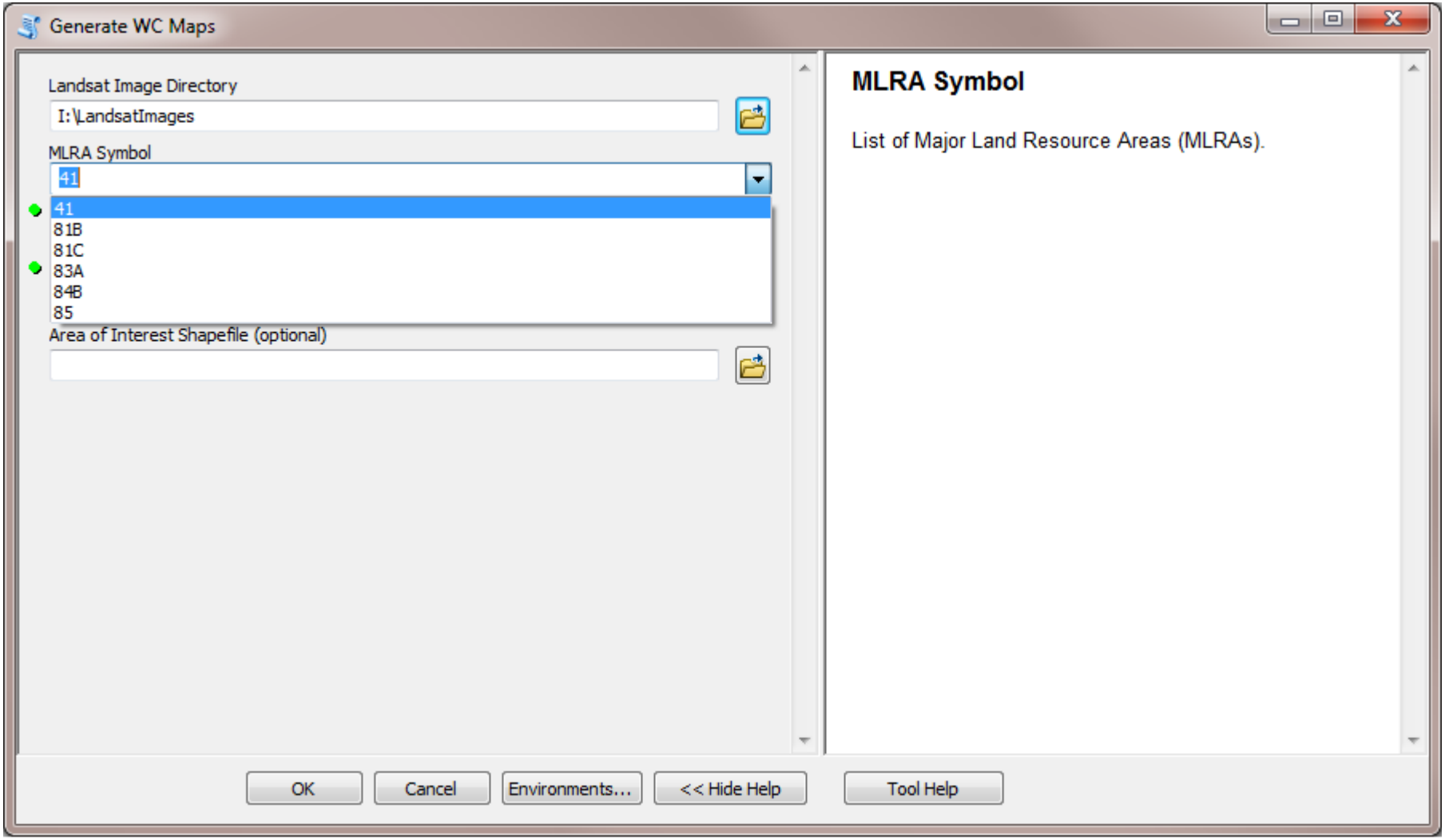
RANGELAND BRUSH ESTIMATION TOOLBOX

- ArcGIS toolbox
- Currently contains two tools:
  - Generate WC Maps
  - RaBET Analysis Tool

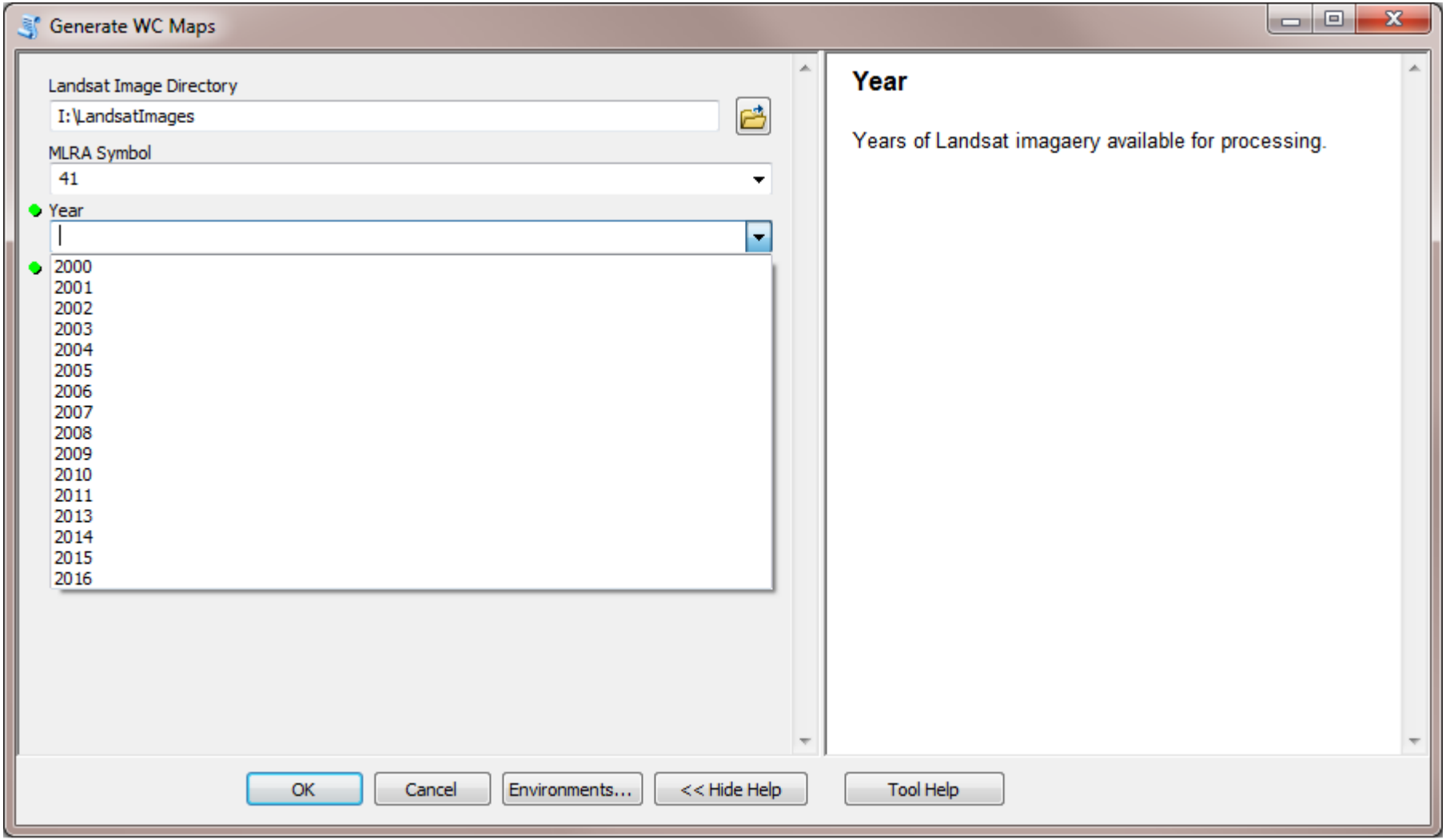
GENERATE WC MAPS

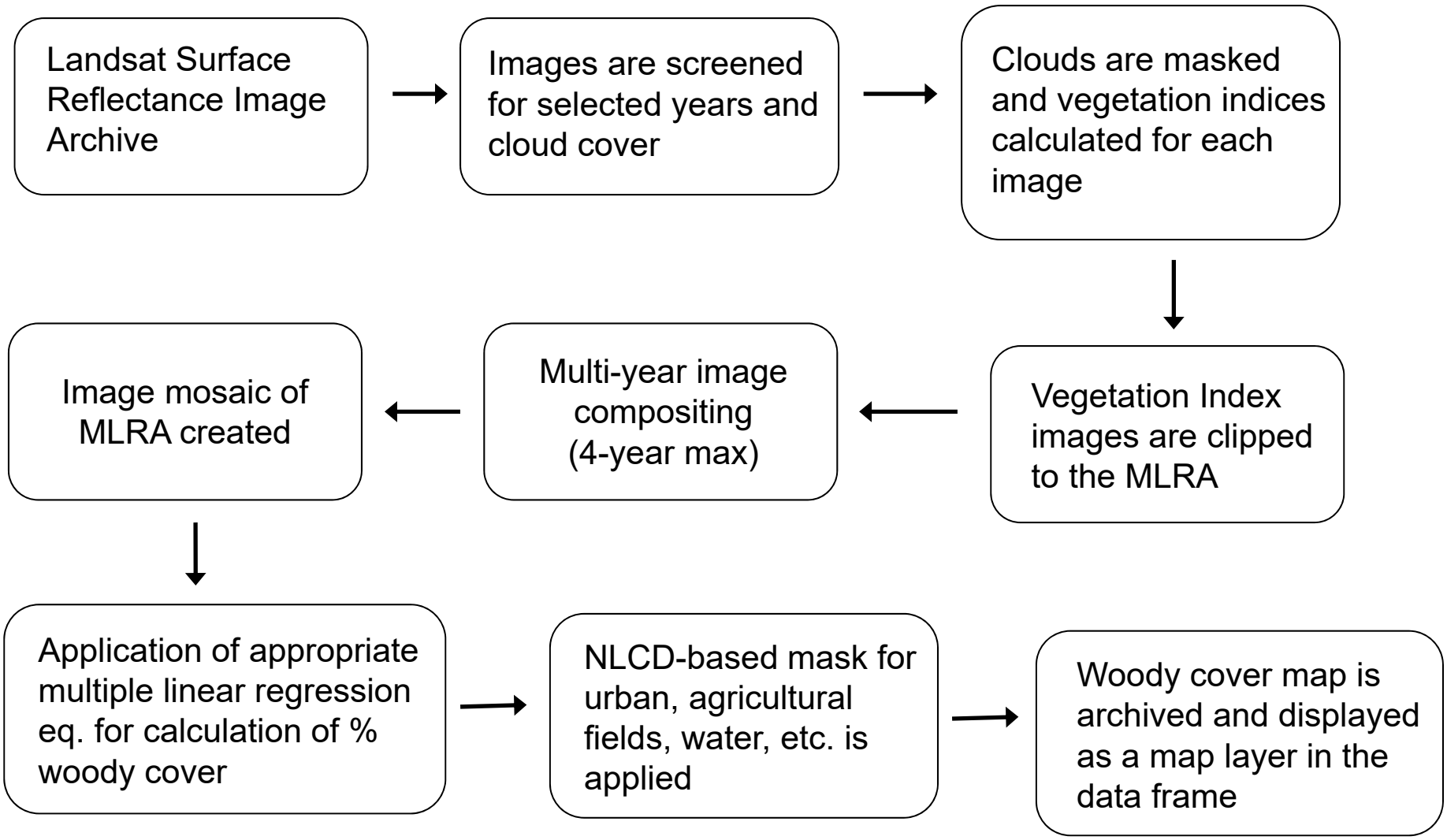


GENERATE WC MAPS

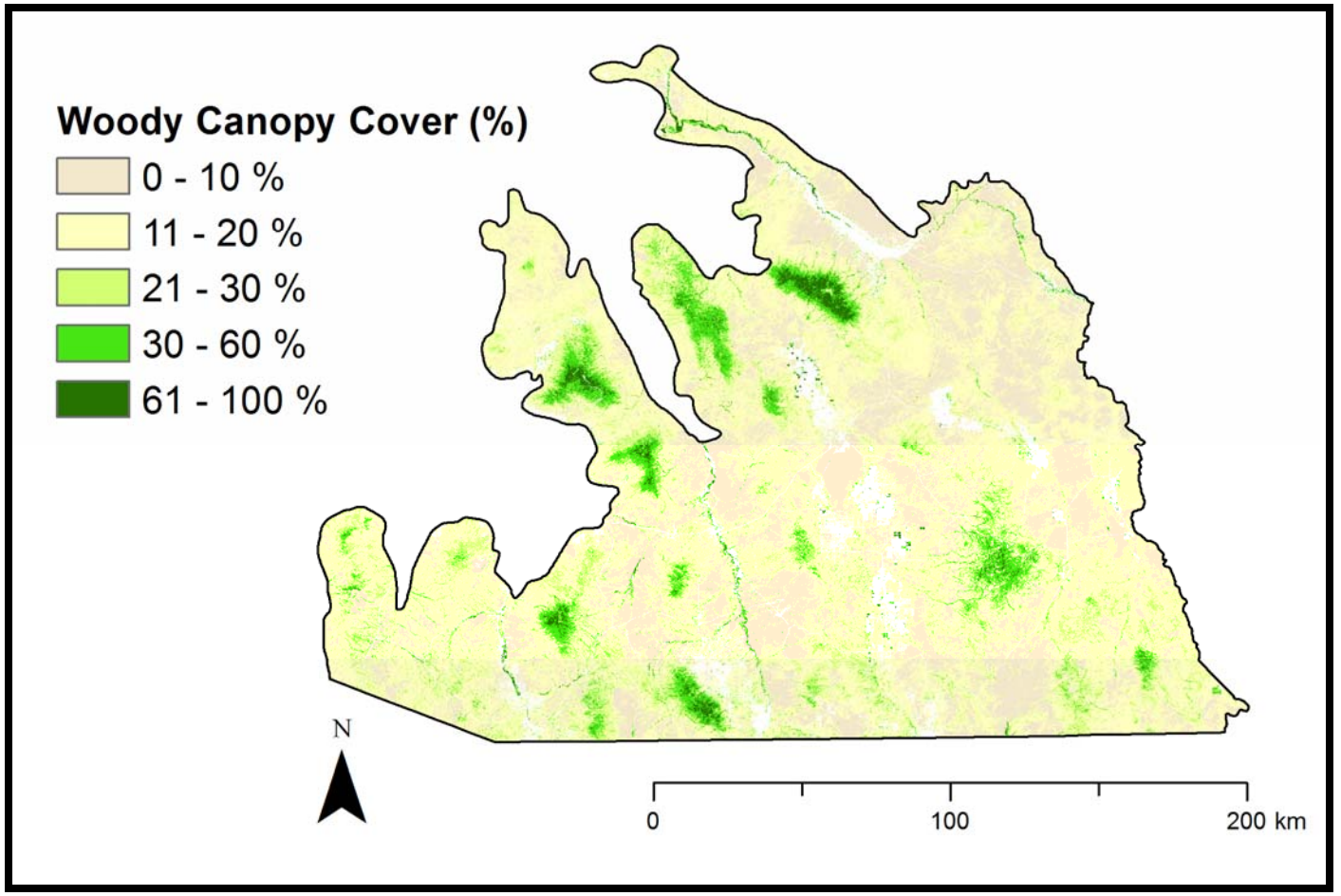


GENERATE WC MAPS



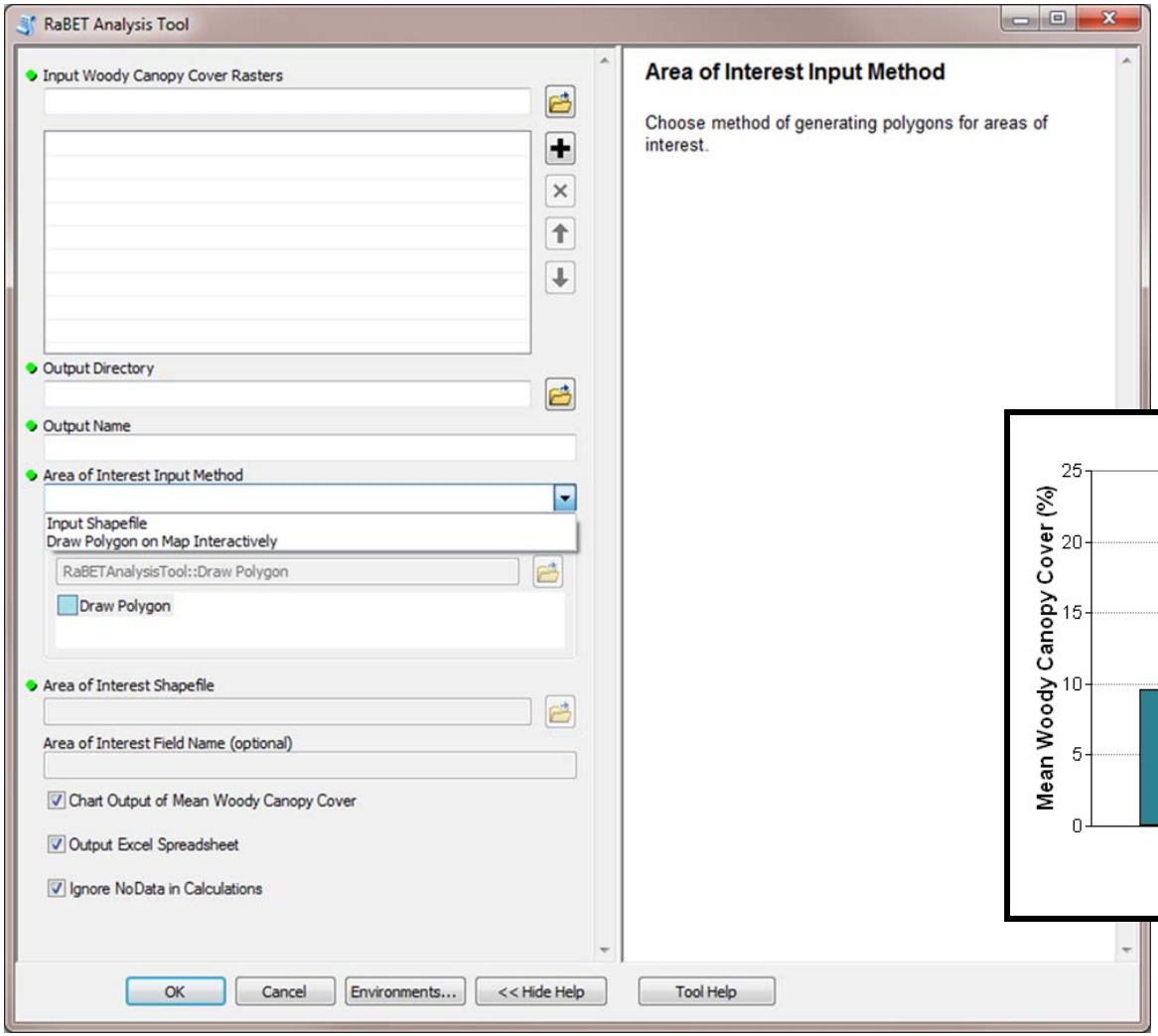

Landsat Surface Reflectance Image Archive
Images are screened for selected years and cloud cover
Clouds are masked and vegetation indices calculated for each image
Vegetation Index images are clipped to the MLRA
Multi-year image compositing (4-year max)
Image mosaic of MLRA created
Application of appropriate multiple linear regression eq. for calculation of % woody cover
NLCD-based mask for urban, agricultural fields, water, etc. is applied
Woody cover map is archived and displayed as a map layer in the data frame

OUTPUT (MLRA 41)

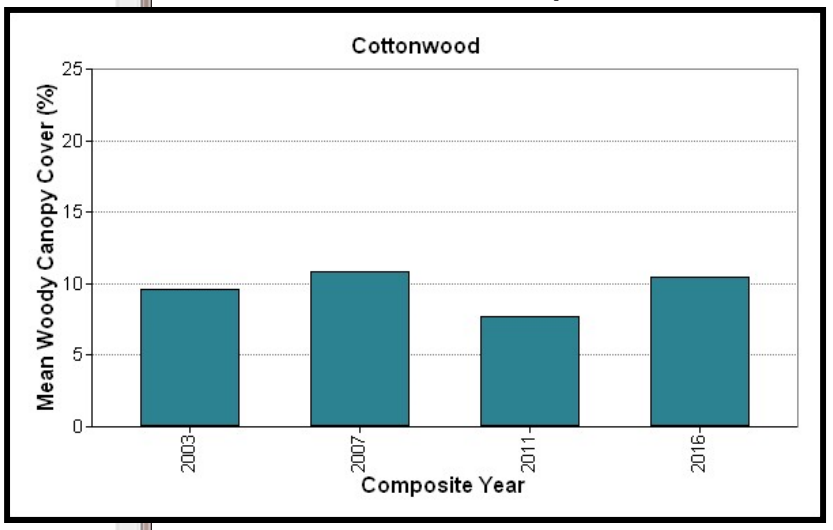


RaBET ANALYSIS TOOL

- The RaBET Analysis Tool was created to facilitate tracking brush treatment effects over time.



Data Chart Output



NEXT STEPS

- Continue validation and algorithm revision to improve woody cover estimation
- Release prototype for user field testing
- Complete user documentation
- Transfer the Generate WC Maps tool into an automated platform on Google Earth Engine

ACKNOWLEDGEMENTS

- Loretta Metz: funding the project
- Mark Kautz: coding the tool
- Susan Skirvin: algorithm development

THANK YOU