Creating Land Cover Input Datasets for the SWAT Model Using Landsat Imagery

Josh Peschel

Master of Science Candidate

Department of Biological & Agricultural Engineering

Project Objective

To develop a method for creating classified land cover grids based on Landsat imagery, which will serve as an input for SWAT model simulations.

Presentation Objectives

EWHT, MPH, Data

Questionphdata

The SWAT Model

SWAT is a watershed modeling tool developed to predict the impact of land management practices over time on:

Water

Sediment

Agricultural Chemicals

The SWAT Model
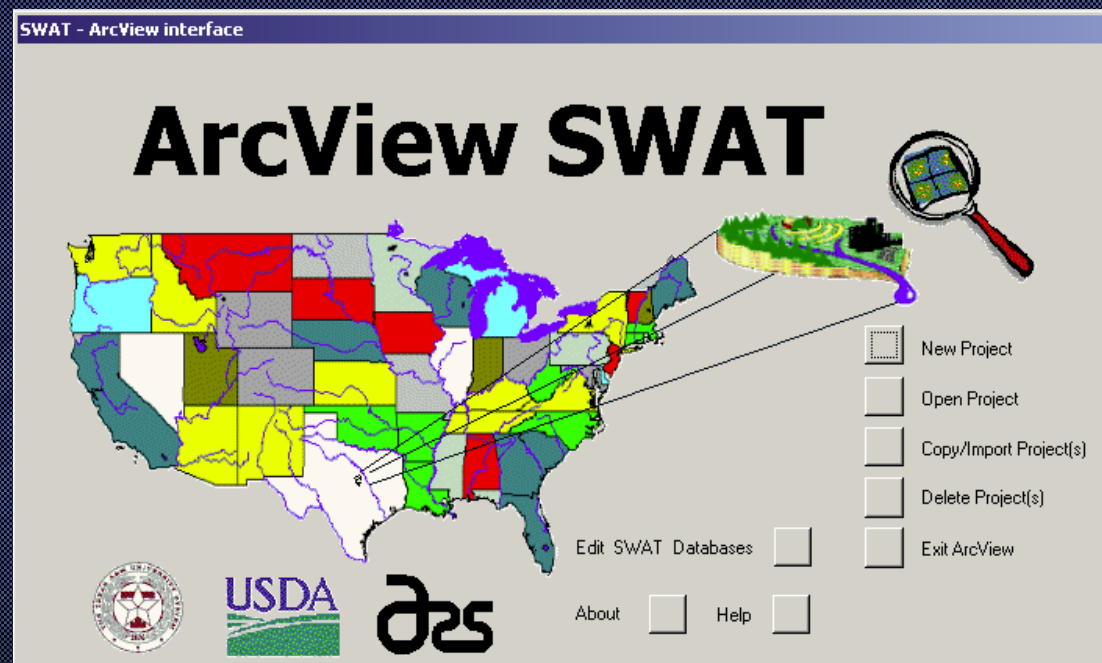
Primary variables within the SWAT model include:

Soil Type

Land Cover and Land Use

Management Practices

The SWAT Model

SWAT 2000 contains an ArcView interface, which allows for the use of digital spatial datasets.
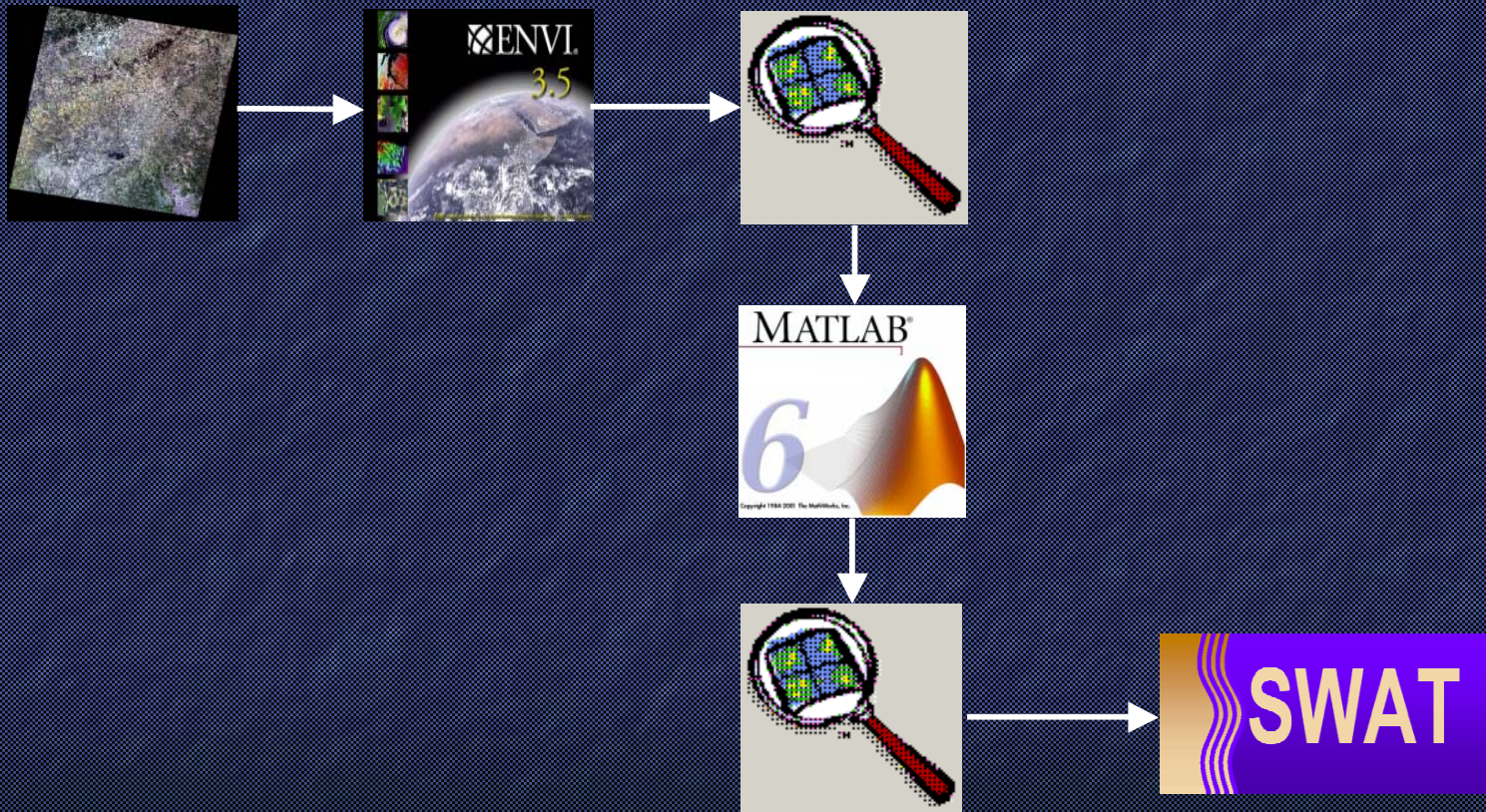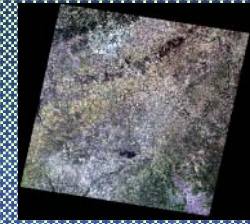
The SWAT Model

The SWAT Model

Requirements:

(1) Land cover input data must be in the form of a grid.

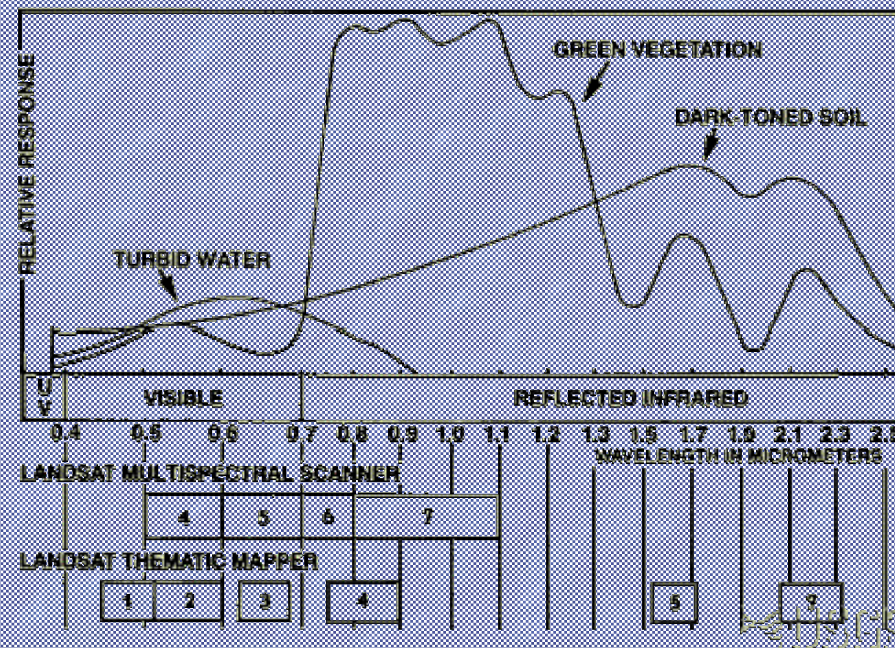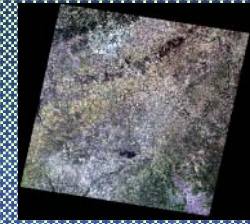(2) Classification system must be close to SWAT system.
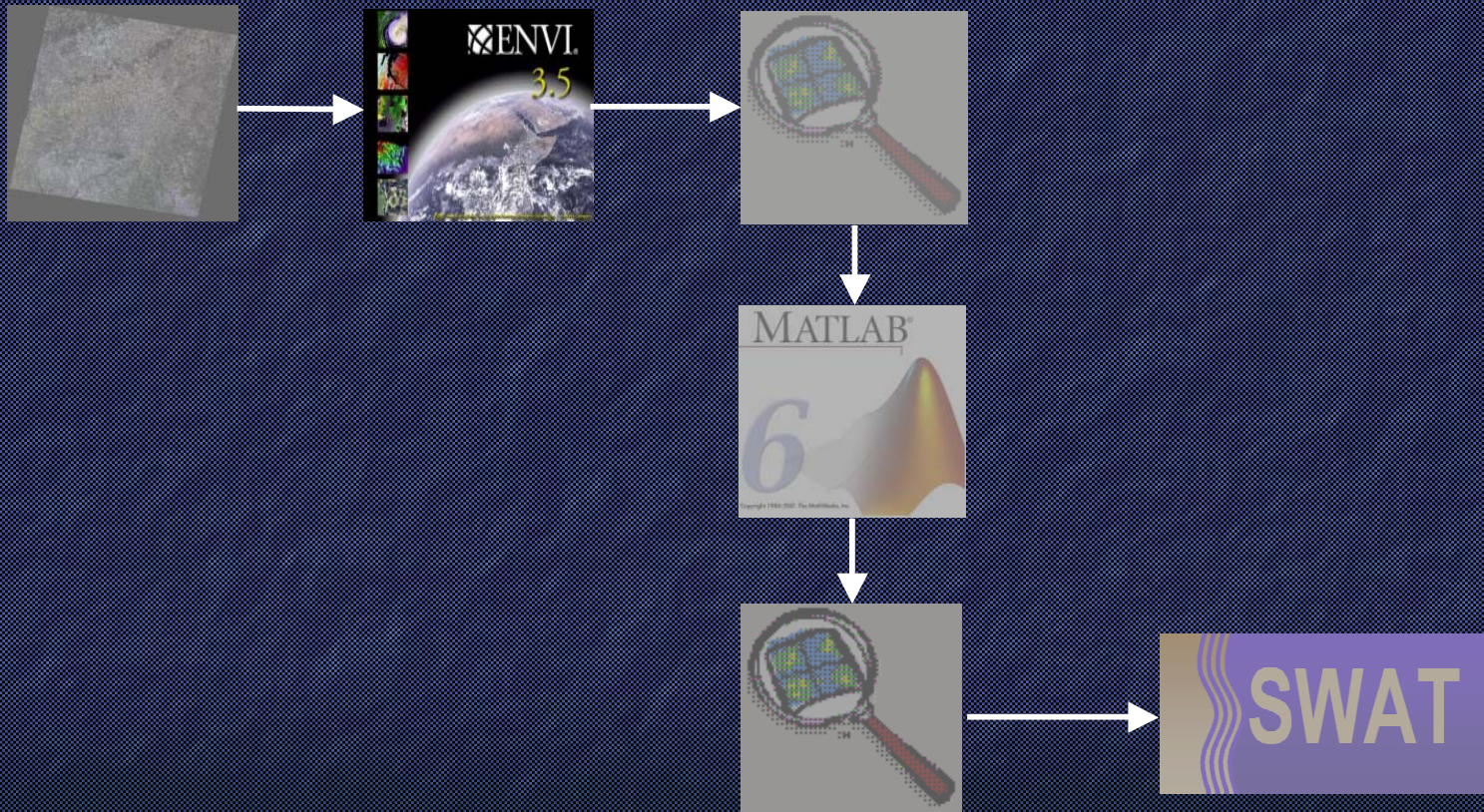
General Methodology

Landsat Imagery

Landsat Imagery

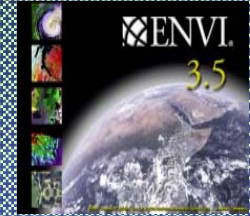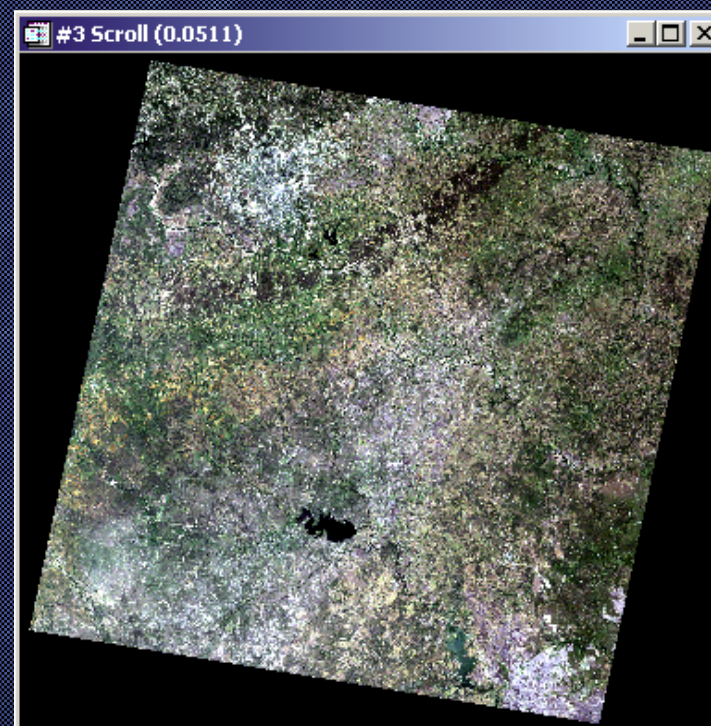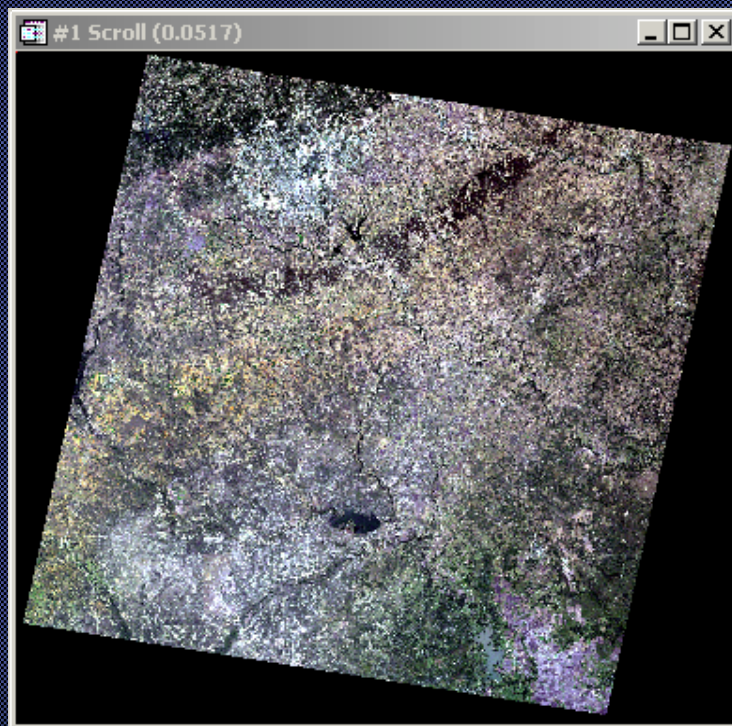| Spectral Channel	Spectral Range [μm]	Spatial Resolution [m]
1	450 - 515	30
2	525 - 605	30
3	630 - 690	30
4	750 - 900	30
5	1550 - 1750	30
6	10400 - 1250	60
7	2090 - 2350	30
Pan	520 - 900	15

Landsat Imagery

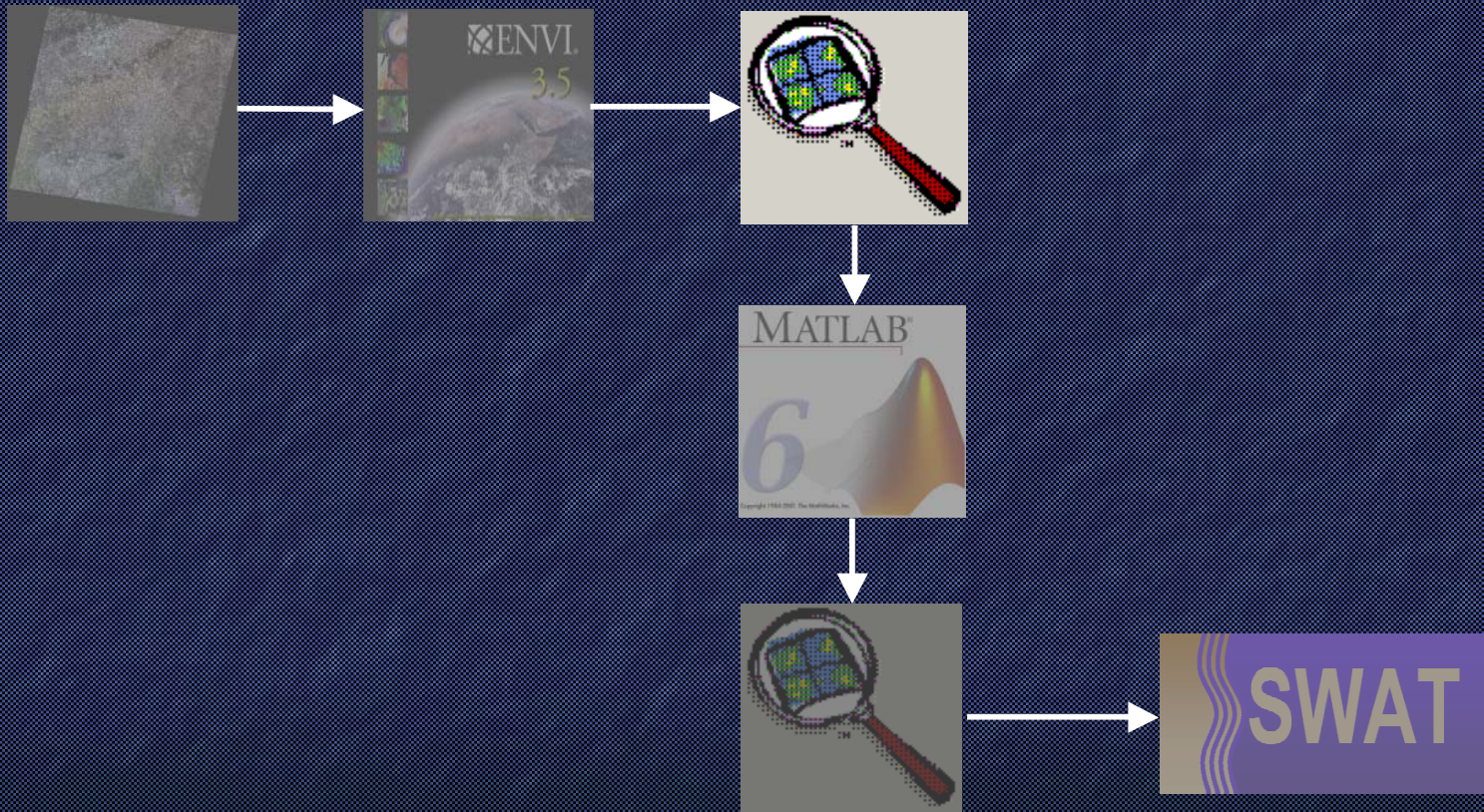# General Methodology

ENVI

The Environment for Visualizing Images (ENVI)

(1) Georeferencing

(2) Image Registration

(3) Raw Format Conversion

ENVI

General Methodology

ArcGIS

Landsat imagery datasets are very large and it is computationally expensive to process an entire scene (185-km x 185-km).

If the area of study is known beforehand, data reduction can be performed by simply eliminating what you aren't going to study.

Case Study: Leon Creek

Data Used in Analysis:

1987 Landsat 5 TM Image (TNRIS)

1999 Landsat 7 ETM+ Image (TNRIS)

USGS DEM (1:24,000) for Bexar County (TNRIS)

Texas Counties Shapefile (ESRI)

United States Shapefile (ESRI)

Reach Files Version 3 (EPA)

Edwards Aquifer Shapefiles (TNRCC)

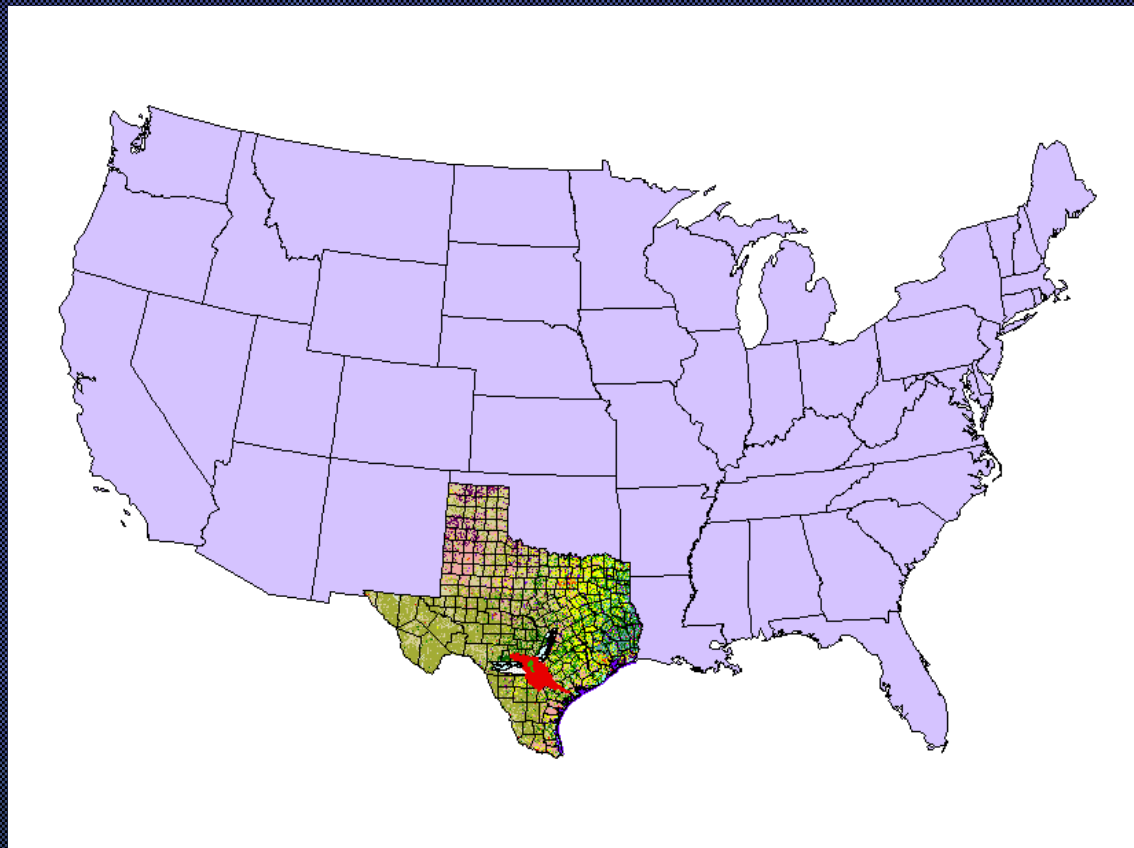Multi-Resolution Land Cover Data (USGS)

Case Study: Leon Creek

The datasets were used to delineate the Leon Creek watershed in San Antonio, Texas.
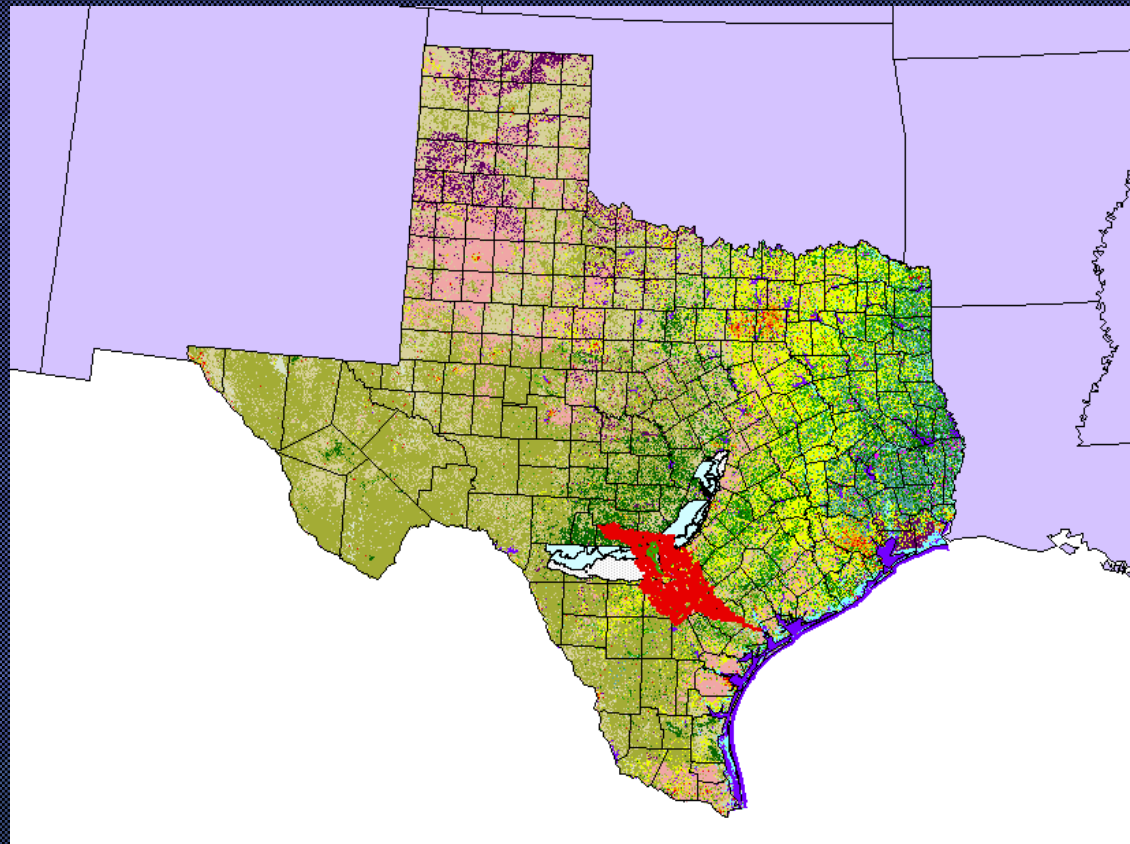
CRWR-PrePro was used as the primary tool.

The Landsat datasets were significantly reduced.
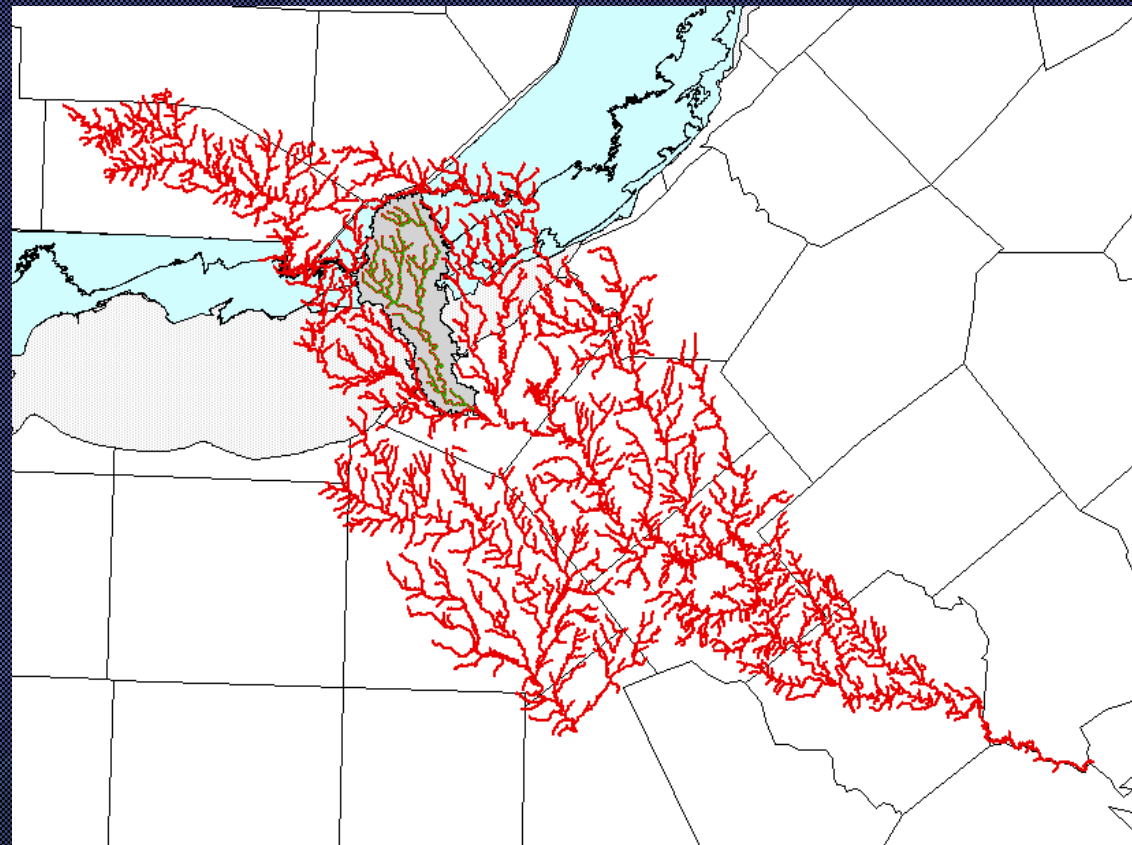
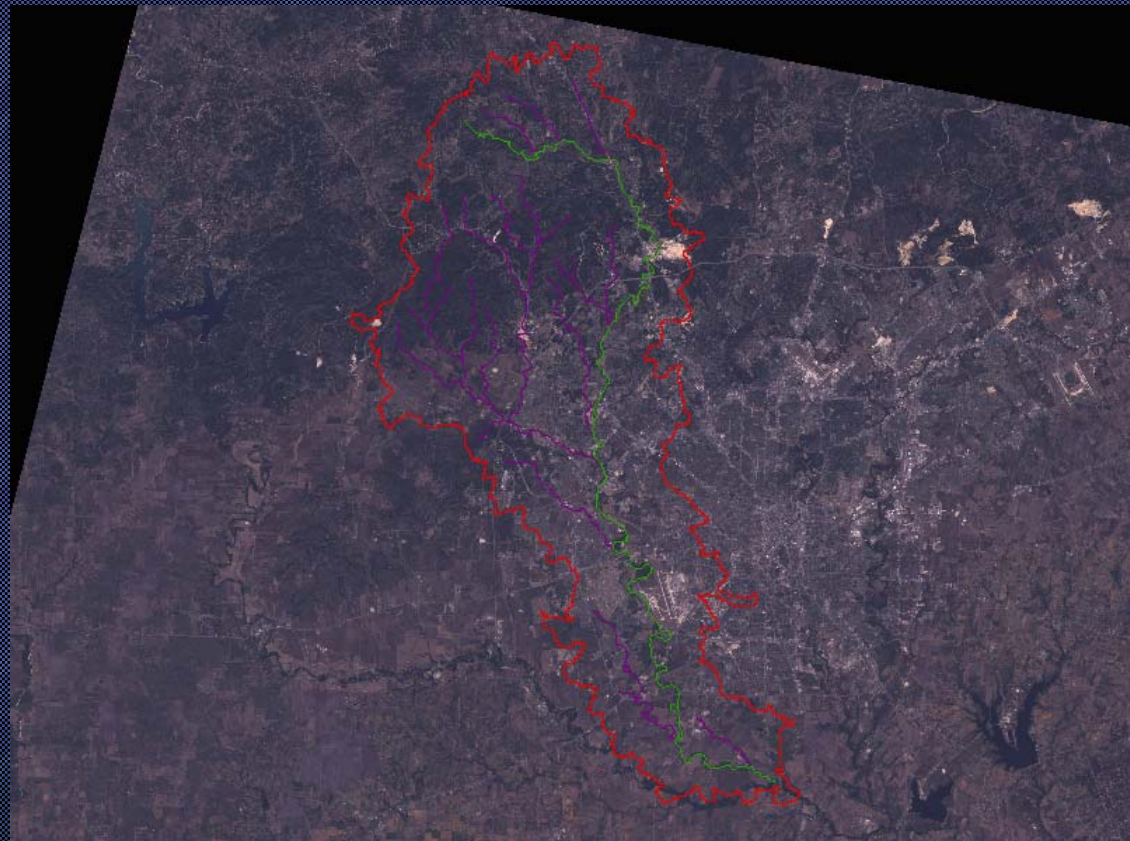Data were exported as an ascii raster text file.
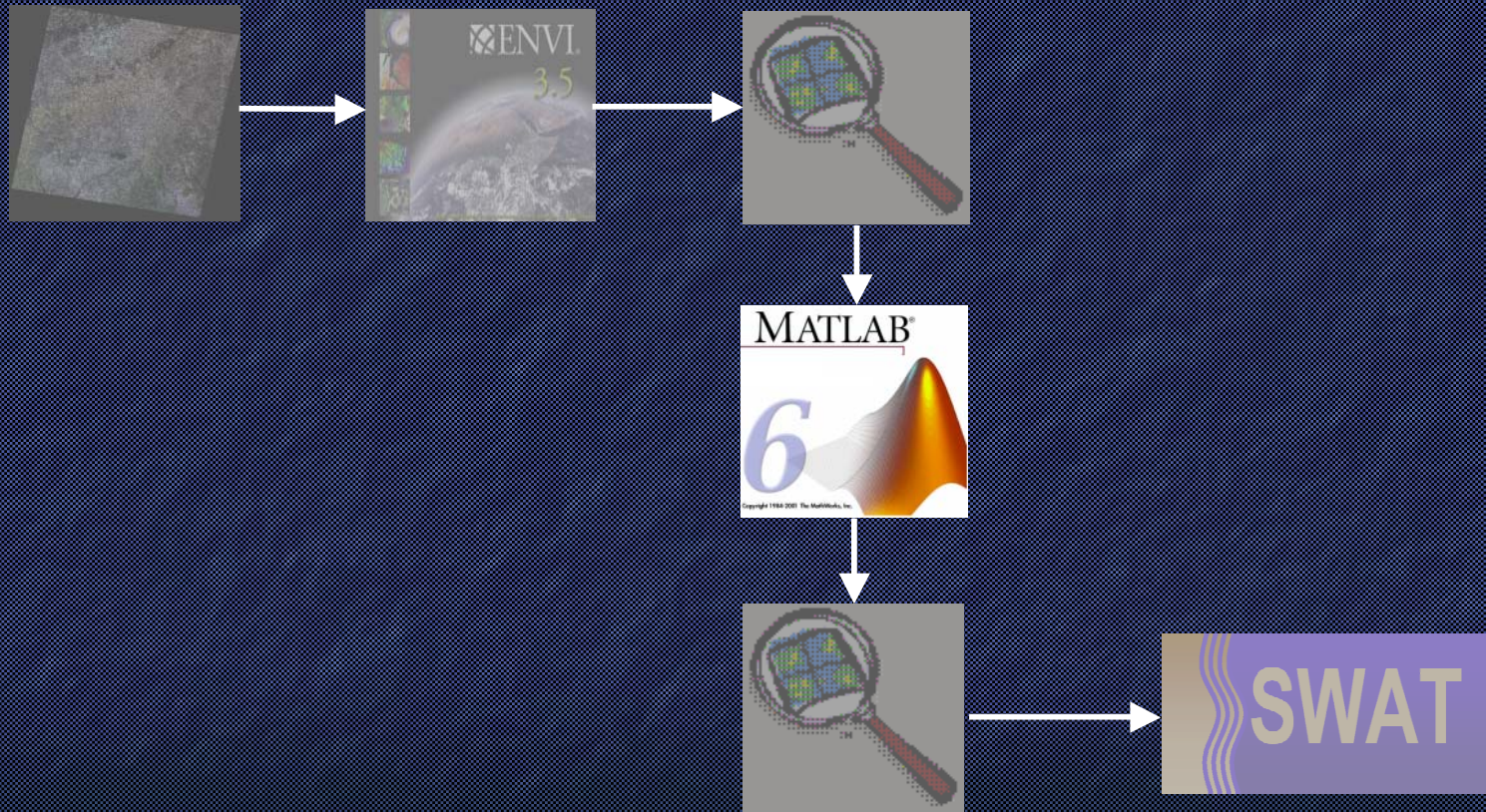
Case Study: Leon Creek
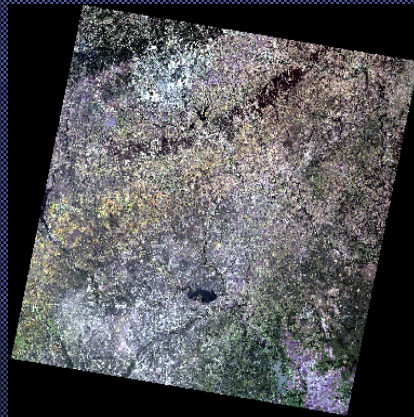
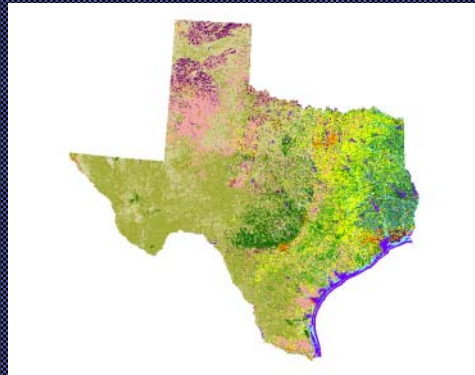# Case Study: Leon Creek
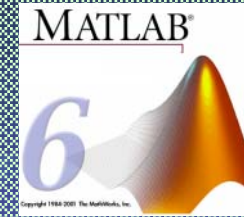
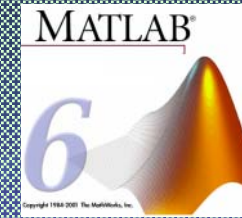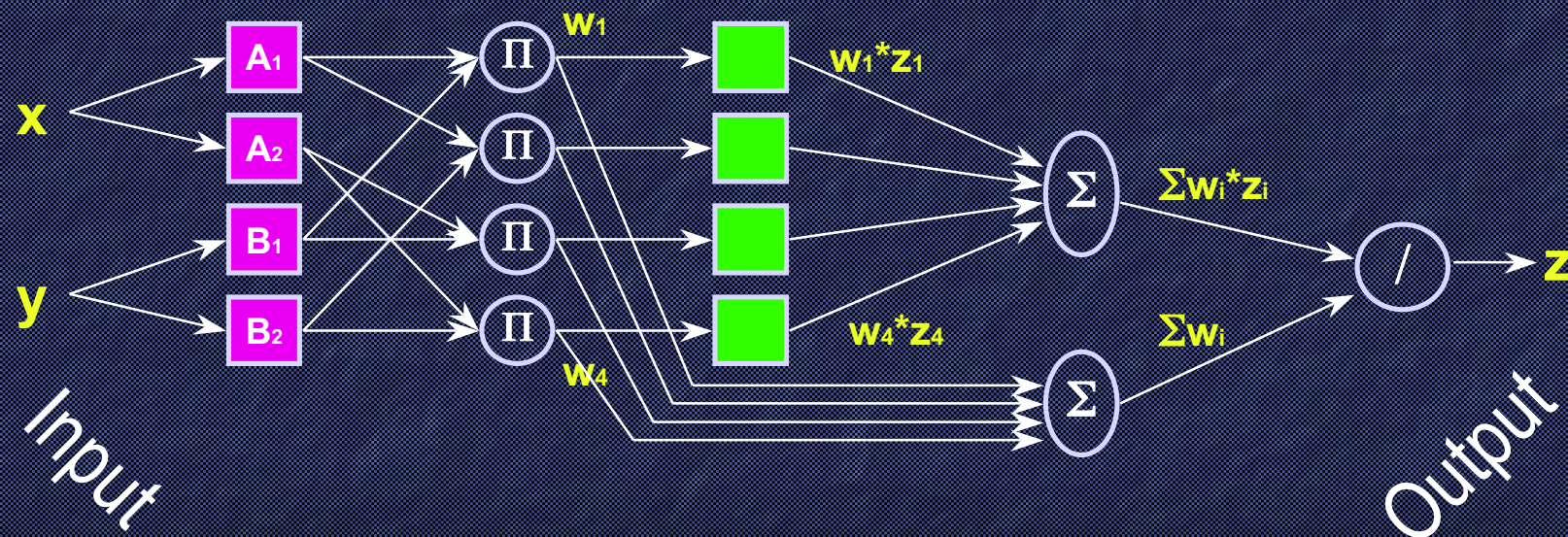# Case Study: Leon Creek

Case Study: Leon Creek

General Methodology

Matlab

Fuzzy Inference System (FIS)

Land Cover Model

Matlab

Adaptive Neuro-Fuzzy Inference System (ANFIS)

Matlab
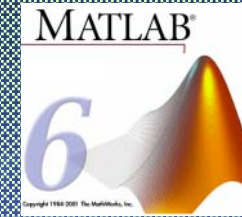
Matlab

Each band pixel into the FIS results in a grid pixel out that is classified. This could be seen as a local function.
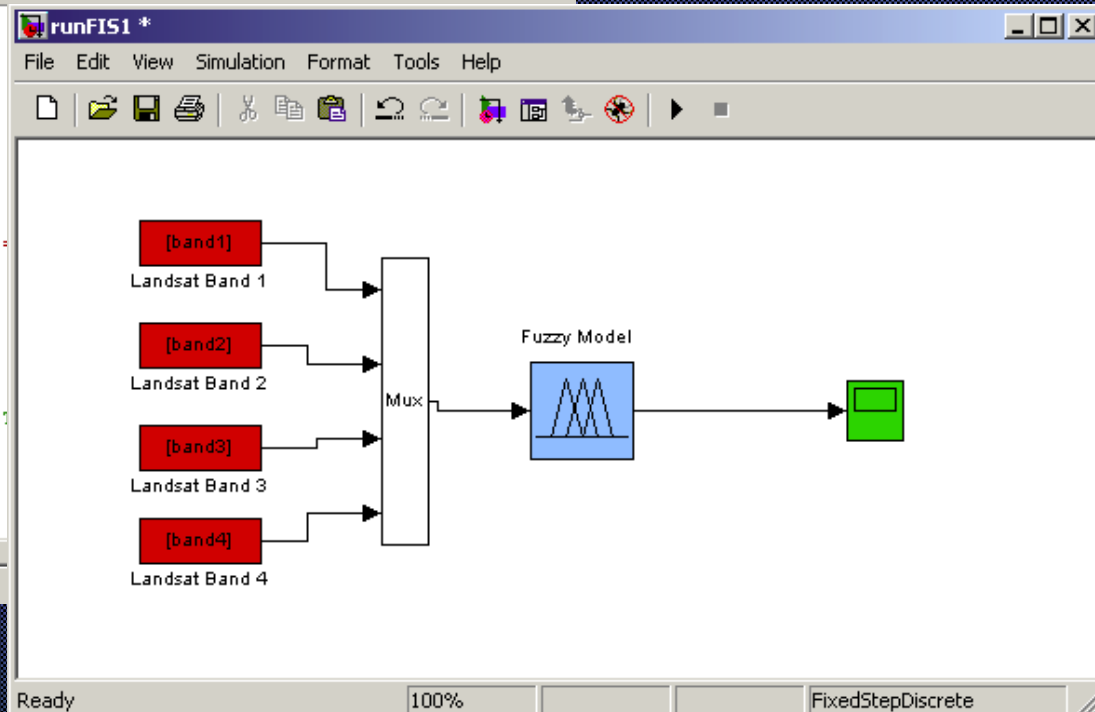
Band 1 →
Band 2 →
Band n →

Land Cover Model

→ Grid

Matlab

The following classifications are assigned:

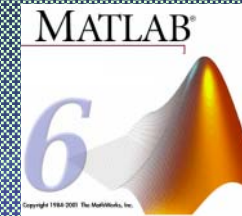|	
■	Open Water
□	Ice and Snow
■	Low Inensity Residential
■	High Intensity Residential
■	Commerical/Industrial/Transportation
■	Bare Rock/Sand/Clay
■	Quarries
■	Transitional
■	Deciduous Forest
■	Evergreen Forest
■	Mixed Forest
■	Shrubland
■	Orchard/Vineyard
■	Grassland/Herbaceous
■	Pasture / Hay
■	Row Crops
■	Small Grains
■	Fallow
■	Urban Recreational Grasses
■	Woody Wetlands
■	Emergent Herbaceous Wetlands
□	
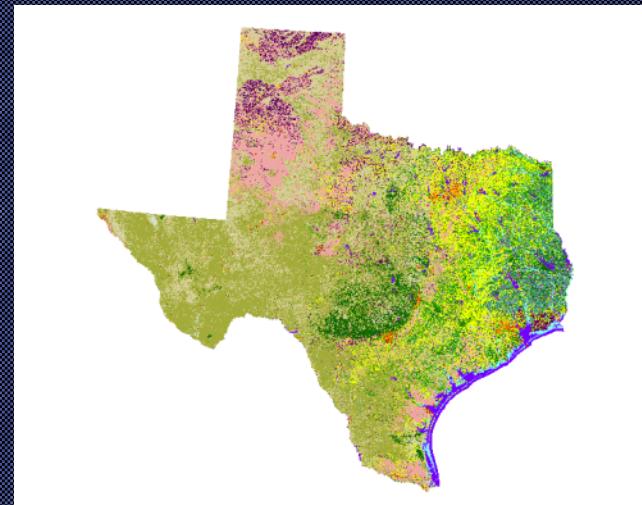
General Methodology
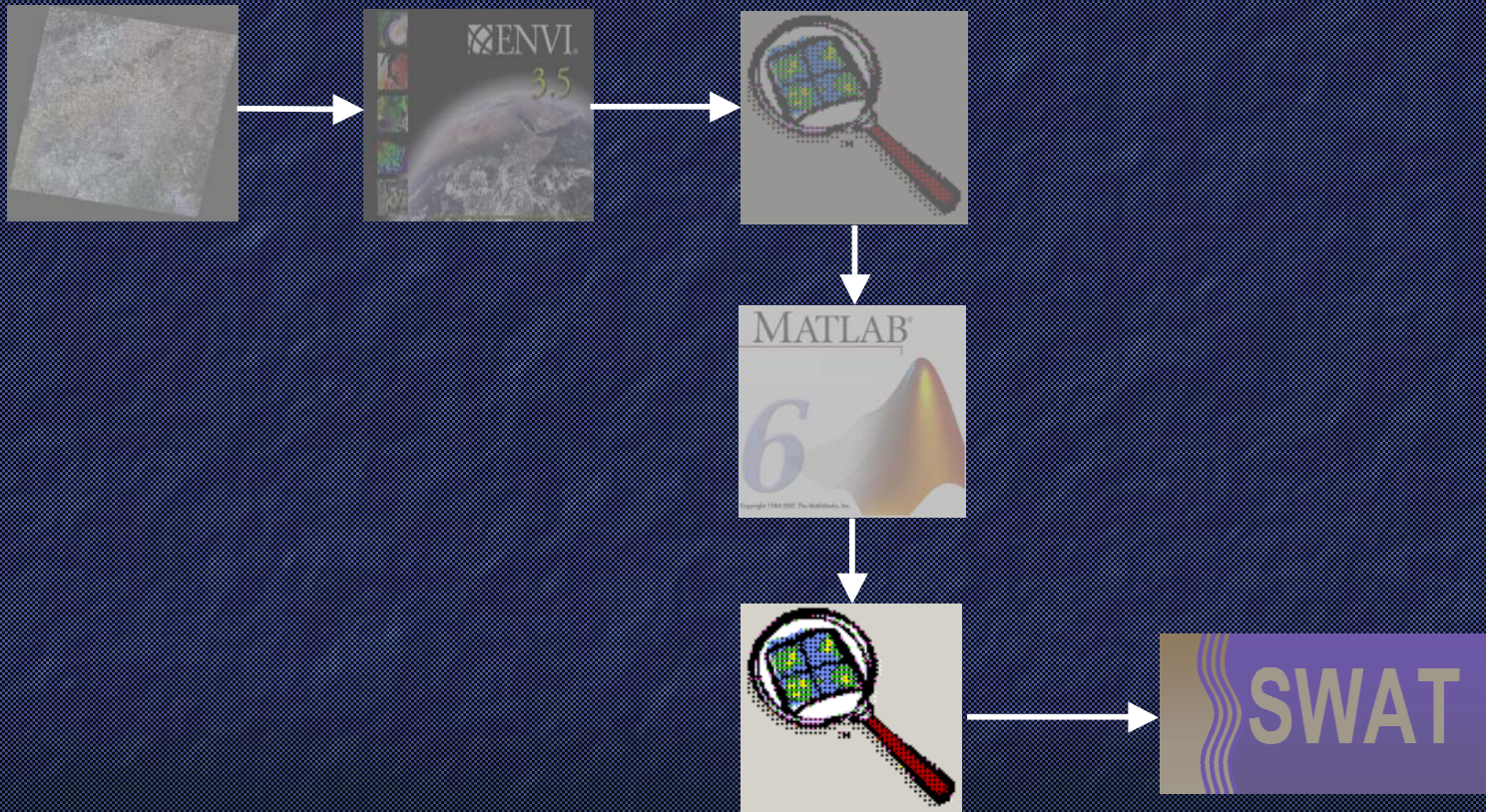
ArcGIS

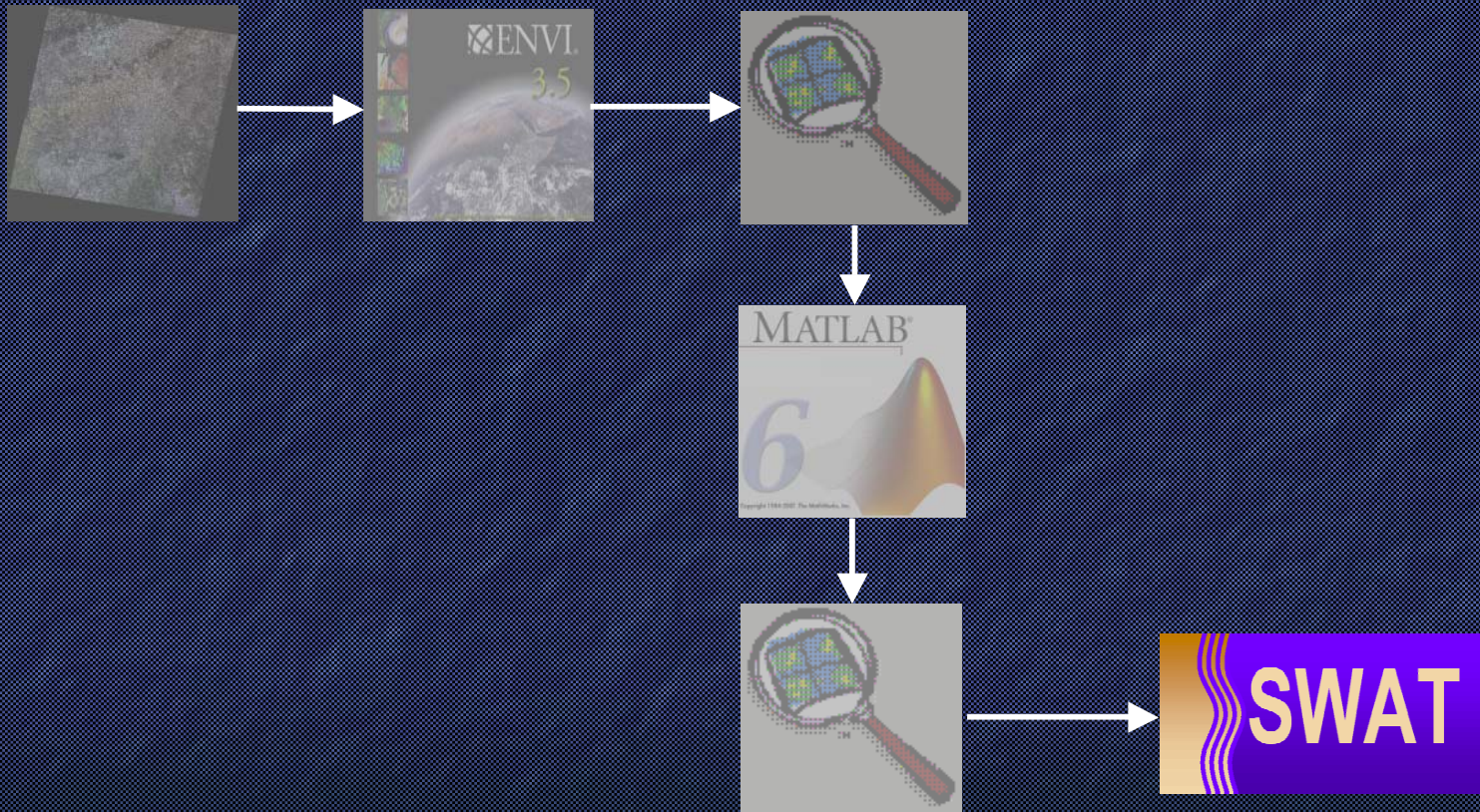The classified ascii text file is brought back to ArcGIS for conversion to a grid.

The grid projection is defined to the specification of the SWAT data.

ArcGIS

It is necessary to add a header to the text file before importing it into ArcGIS:

General Methodology

What is Working?

The data is all in the correct projection.

Matlab scripts seem to be working right.

Grids are produced from the FIS.

What is Not Working?

The grids that are produced look bad.

Datasets still appear to be too large.

Future Work

Try different membership functions to get a better FIS.

Produce a verifiably accurate grid.

Test the grid out in SWAT.

Questions?