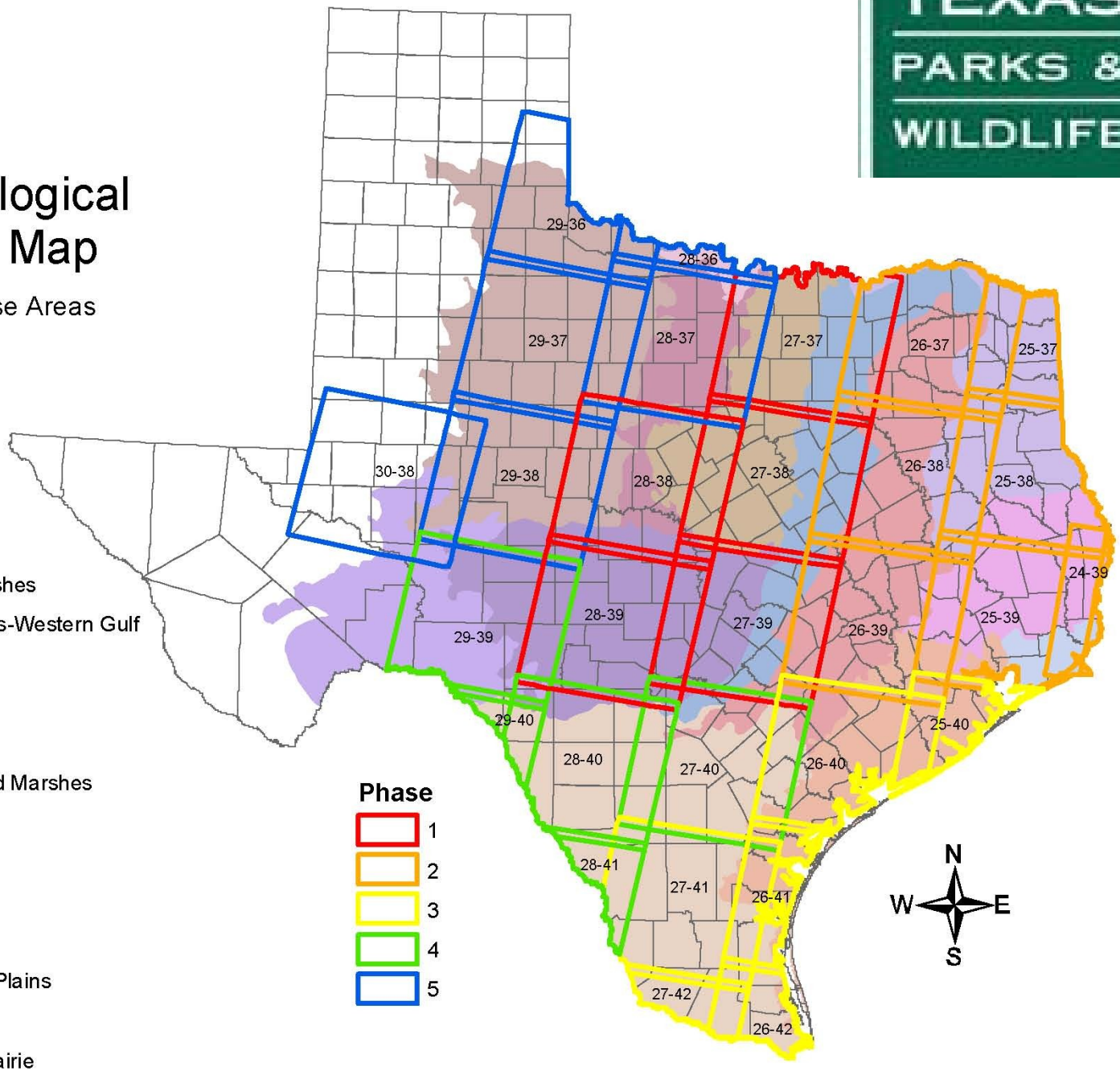
Texas Ecological Systems Map

Proposed Phase Areas



Ecoregion

- Blackland Prairie
- Central Gulf Prairie and Marshes
- Coastal Plains and Flatwoods-Western Gulf
- Cross Timbers and Prairie
- Eastern Rolling Plains
- Edwards Plateau
- Louisiana Coastal Prairie and Marshes
- Mid Coastal Plains-Western
- Oak Woods and Prairie
- Rio Grande Plain
- Rolling Plains
- South Central and Red Bed Plains
- Stockton Plateau
- Texas Cross Timbers and Prairie

Phase

1
2
3
4
5

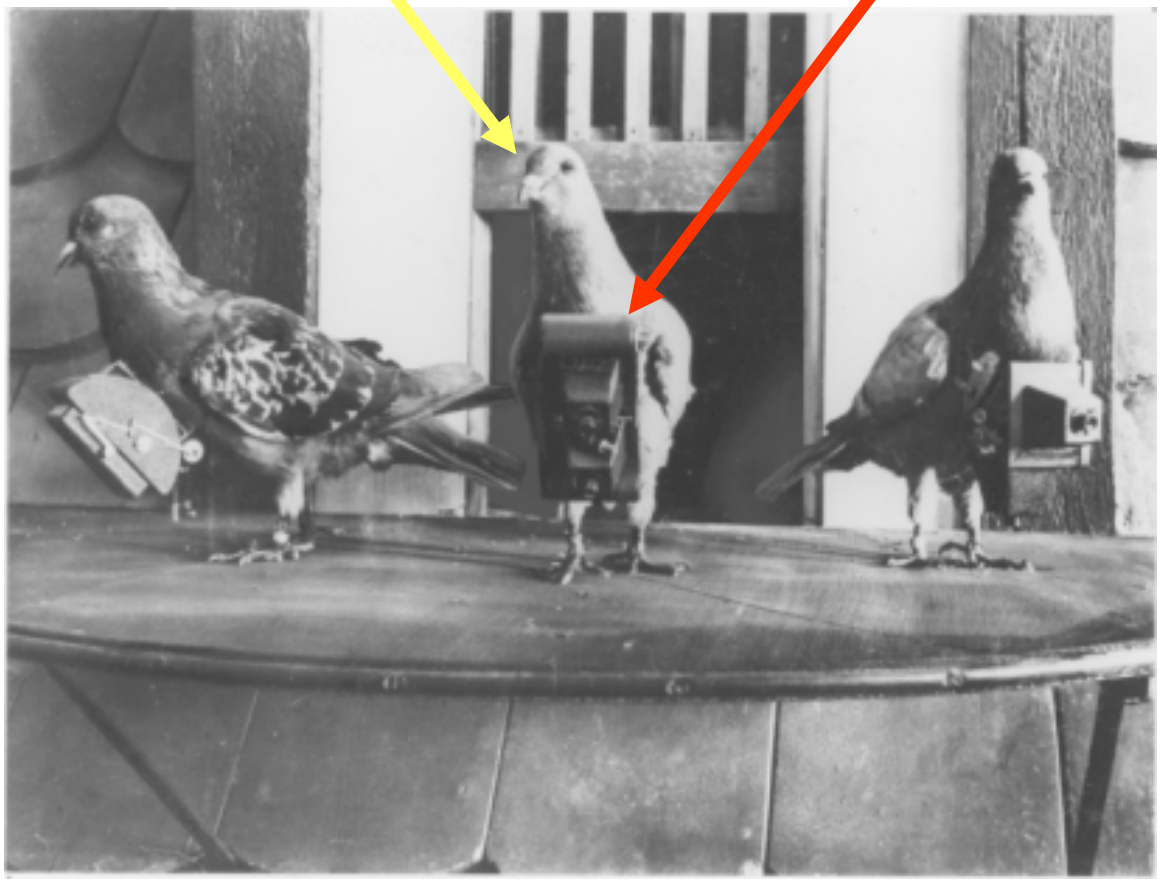
Project Background

- TPWD wants better land cover for Texas
  - Better thematic resolution (more land cover classes at approximately the ecological system level)
  - Better spatial resolution (approaching 1:24,000)
  - Better accuracy (overall 85%)
- TPWD is working with partners
  - NatureServe and TNC will help define target land cover classes (ecological systems) for mapping
  - TX FS will help with GIS and ground verification
  - MoRAP will help with land cover classification (e.g. image processing) and interpretation (e.g. vegetation dynamics)
  - TPWD will handle on-the-ground surveys and all project coordination

Ecological Systems Summary

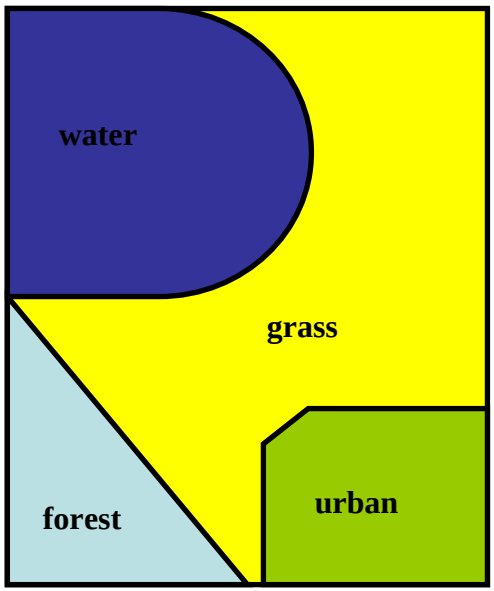
- Ecological systems are designed partly for use in mapping
- A national draft exists & is being modified
- NatureServe is coordinating the classification revision
- USGS is coordinating the LandFire classification effort
- USFS is the overall LandFire lead
- Key is that the ecological systems revision process needs to stay ahead of classification efforts

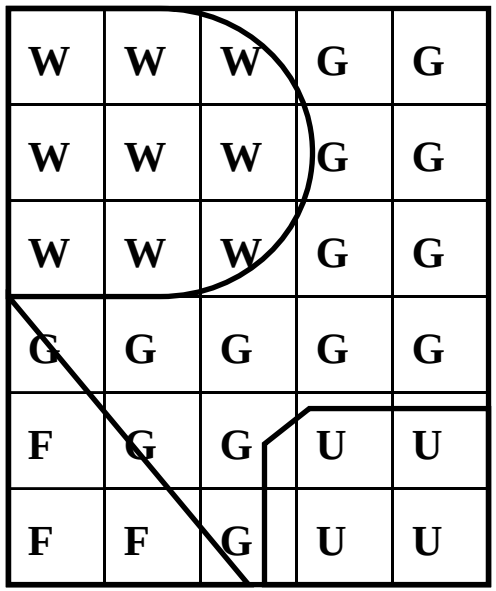
Platform and Sensor

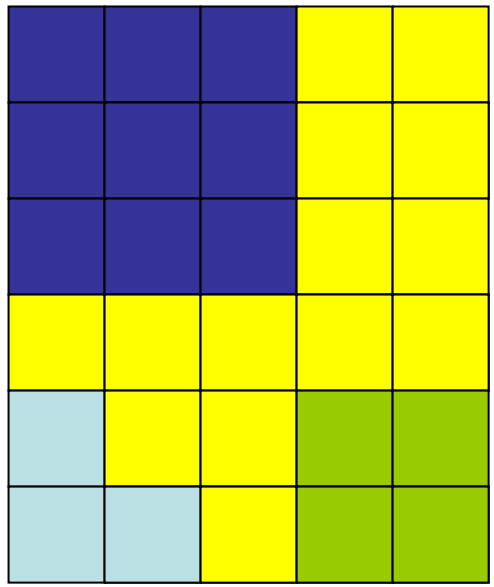


Mapping is Classification of Pixels

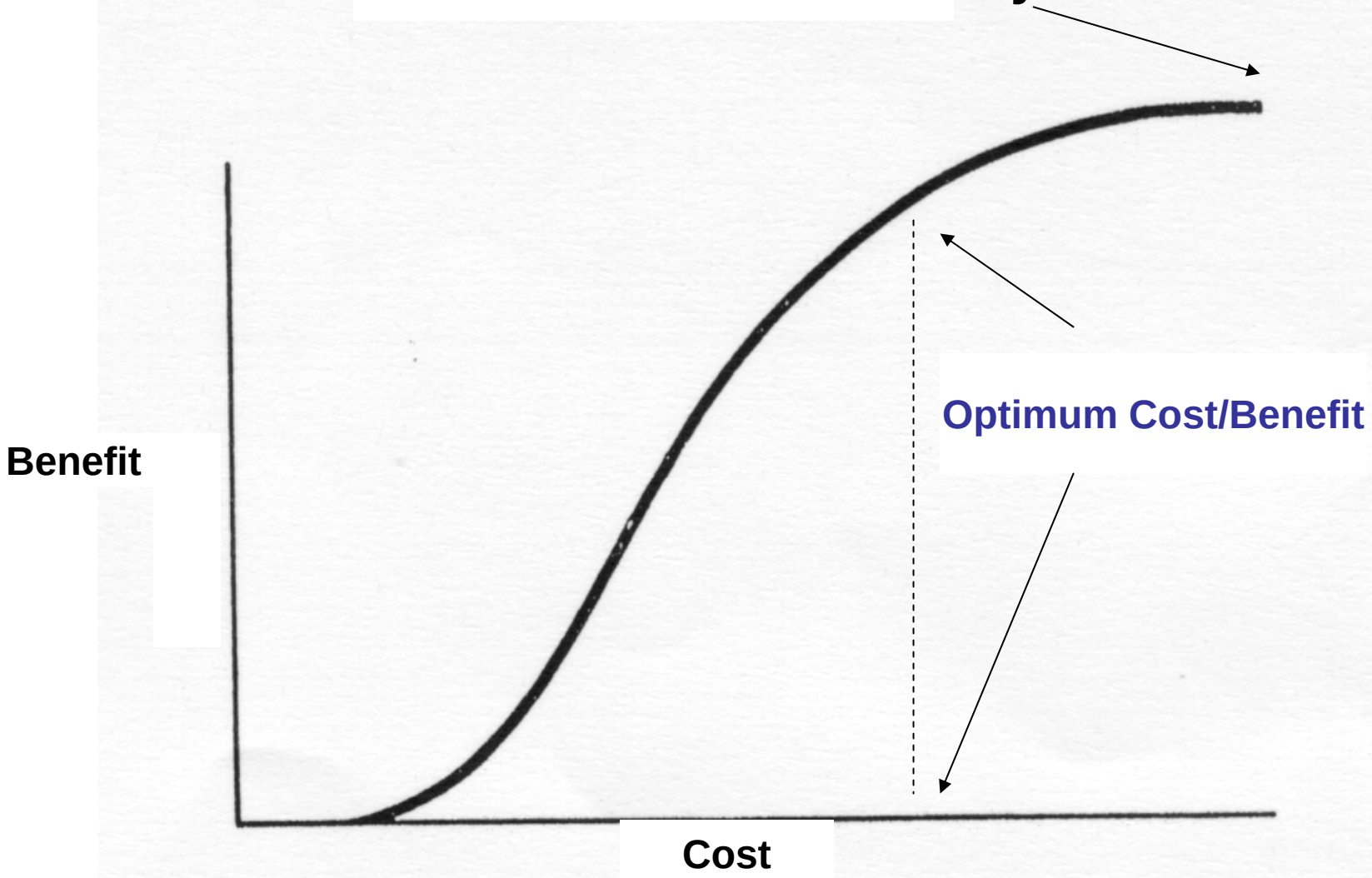
- Create a land cover raster by coding each pixel with a value that represents the land cover type over the majority of that cell's area
- When finished, every cell will have a coded value (**thematic resolution** depends on the number of land cover classes identified)
- Average TM scene is about 34.9 x10^6 pixels







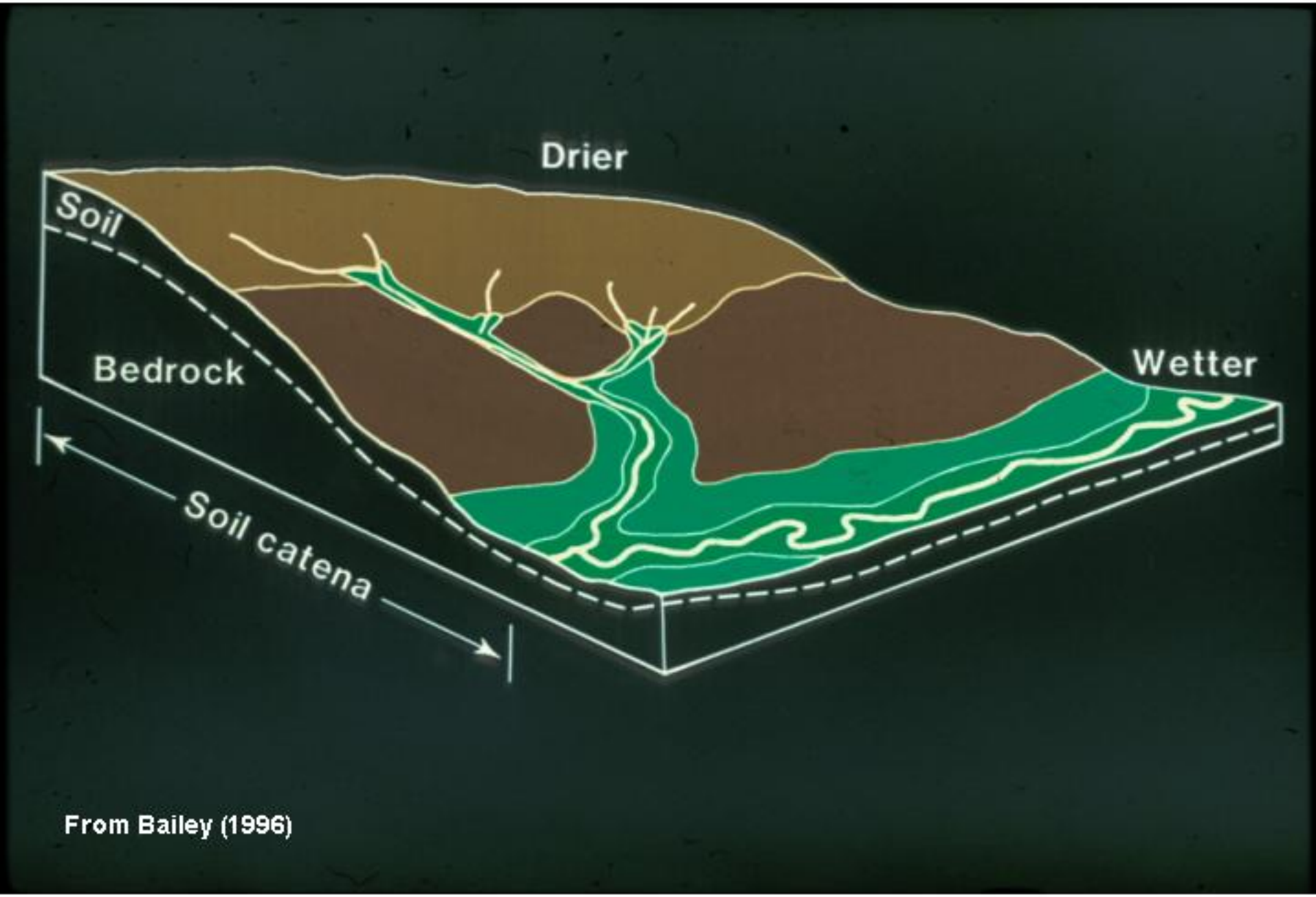
Perfect Results are Too Costly



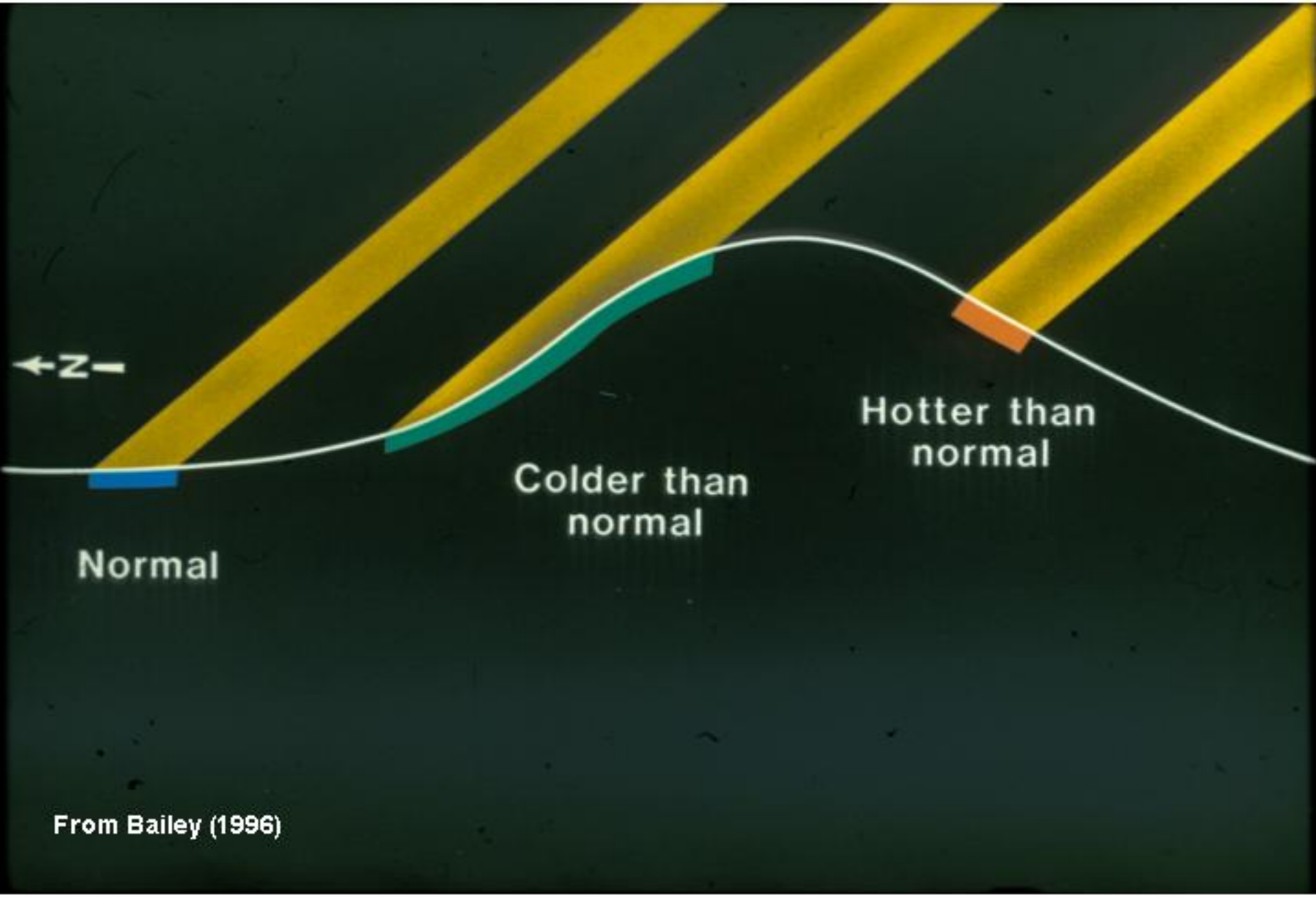
Satellite ETM+ merged data or ETM+/SPOT merged data may be good spatial resolution for this project

Achieving Higher Thematic Resolution

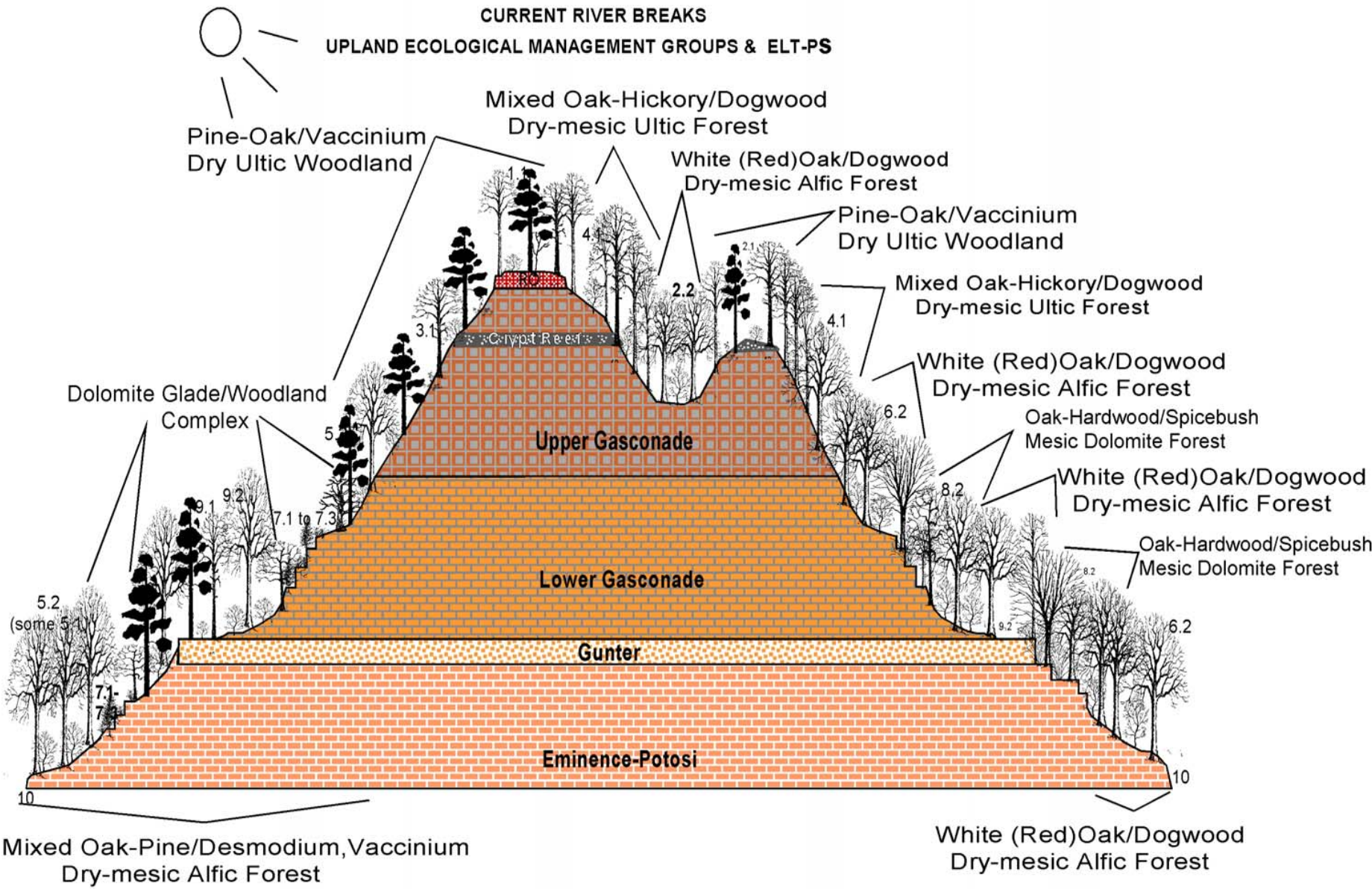
- Satellite data alone are not sufficient to classify all ecological systems (“thematic resolution”)
- Therefore, environmental data are needed



From Bailey (1996)



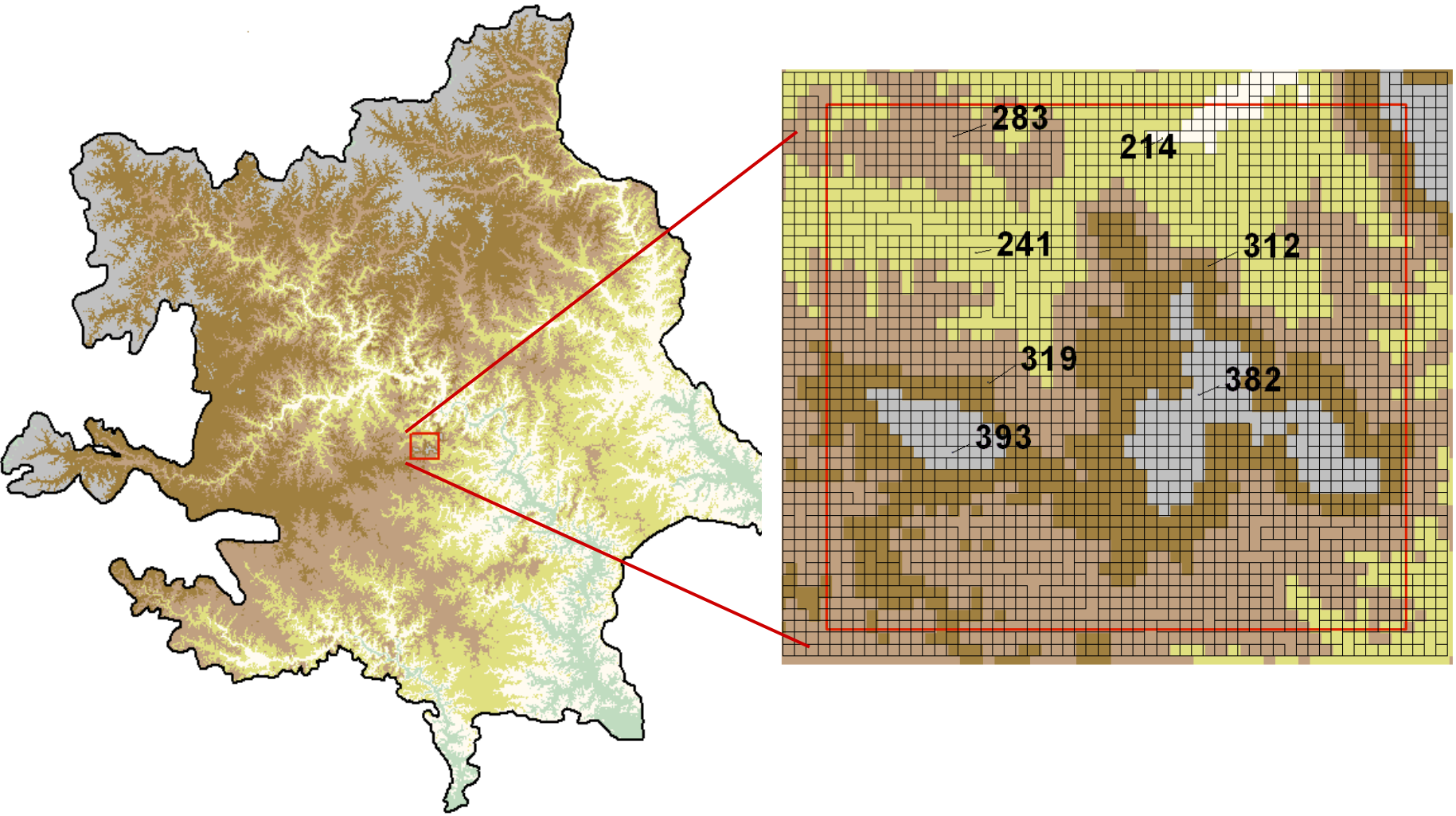
From Bailey (1996)


CURRENT RIVER BREAKS
UPLAND ECOLOGICAL MANAGEMENT GROUPS & ELT-PS
Pine-Oak/Vaccinium
Dry Ultic Woodland
Mixed Oak-Hickory/Dogwood
Dry-mesic Ultic Forest
White (Red)Oak/Dogwood
Dry-mesic Alfic Forest
Pine-Oak/Vaccinium
Dry Ultic Woodland
Mixed Oak-Hickory/Dogwood
Dry-mesic Ultic Forest
White (Red)Oak/Dogwood
Dry-mesic Alfic Forest
Oak-Hardwood/Spicebush
Mesic Dolomite Forest
White (Red)Oak/Dogwood
Dry-mesic Alfic Forest
Oak-Hardwood/Spicebush
Mesic Dolomite Forest
Dolomite Glade/Woodland
Complex
Crypt Reef
Upper Gasconade
Lower Gasconade
Gunter
Eminence-Potosi
1.1
4.1
2.1
2.2
4.1
3.1
5
6.2
8.2
9.1
9.2
7.1 to 7.3
5.2
(some 5.1)
7.1-
7.3
10
Mixed Oak-Pine/Desmodium,Vaccinium
Dry-mesic Alfic Forest
White (Red)Oak/Dogwood
Dry-mesic Alfic Forest

Analysis of Relatively Fine-resolution Abiotic Variation

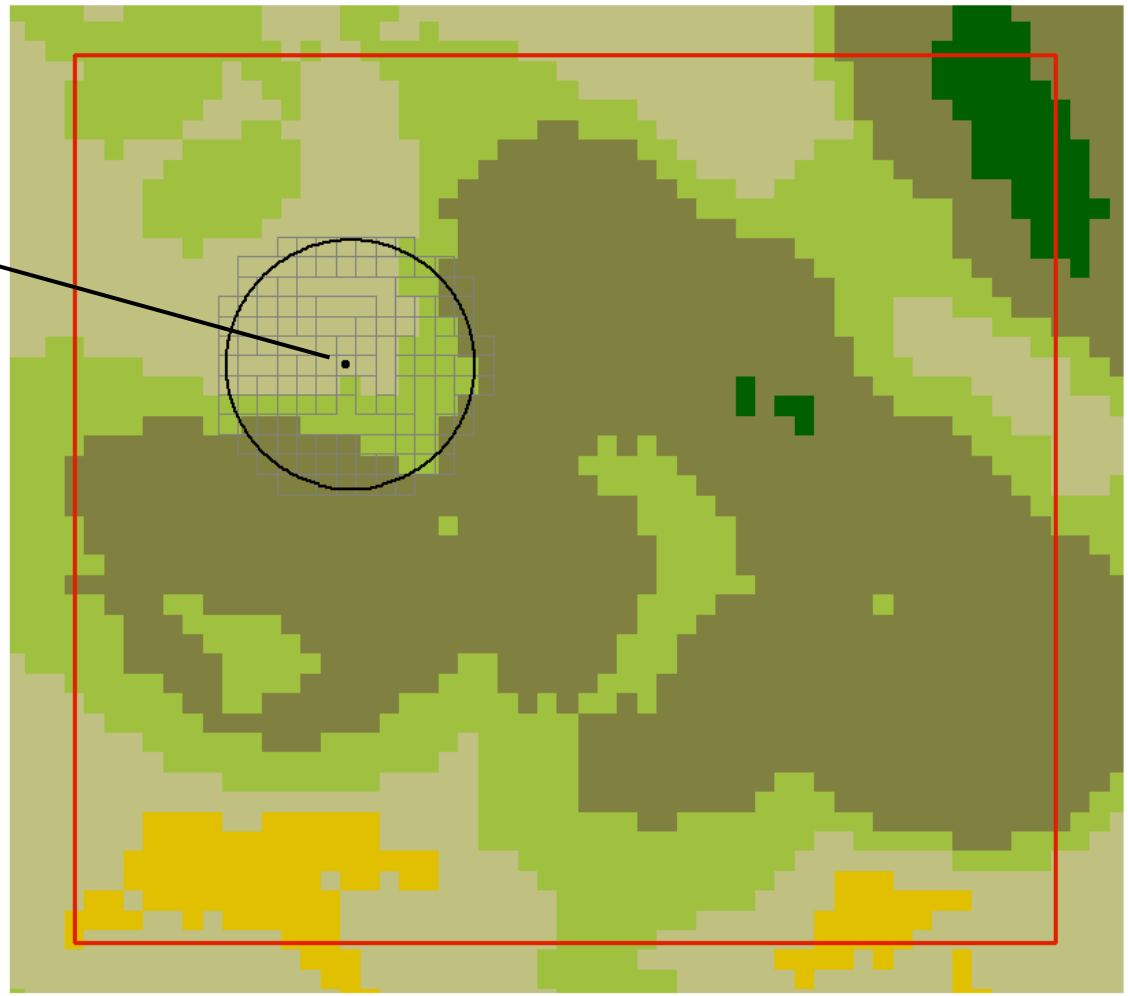
- Two basic, relatively uniform, datasets:
  - Digital elevation models (30m available statewide; 10m in the works)
  - SSURGO soils (digital county soil surveys available across most of the state)
- BEG 15' Geologic Quads (Geologic Atlas of Texas, 1:250,000) are also available and may prove useful, especially where SSURGO soils data are not available

Modeling abiotic variables: Digital Elevation Models (DEMs) - elevation is represented by a regular grid with elevation values



Neighborhood analysis example: the elevation range surrounding the center cell is relief

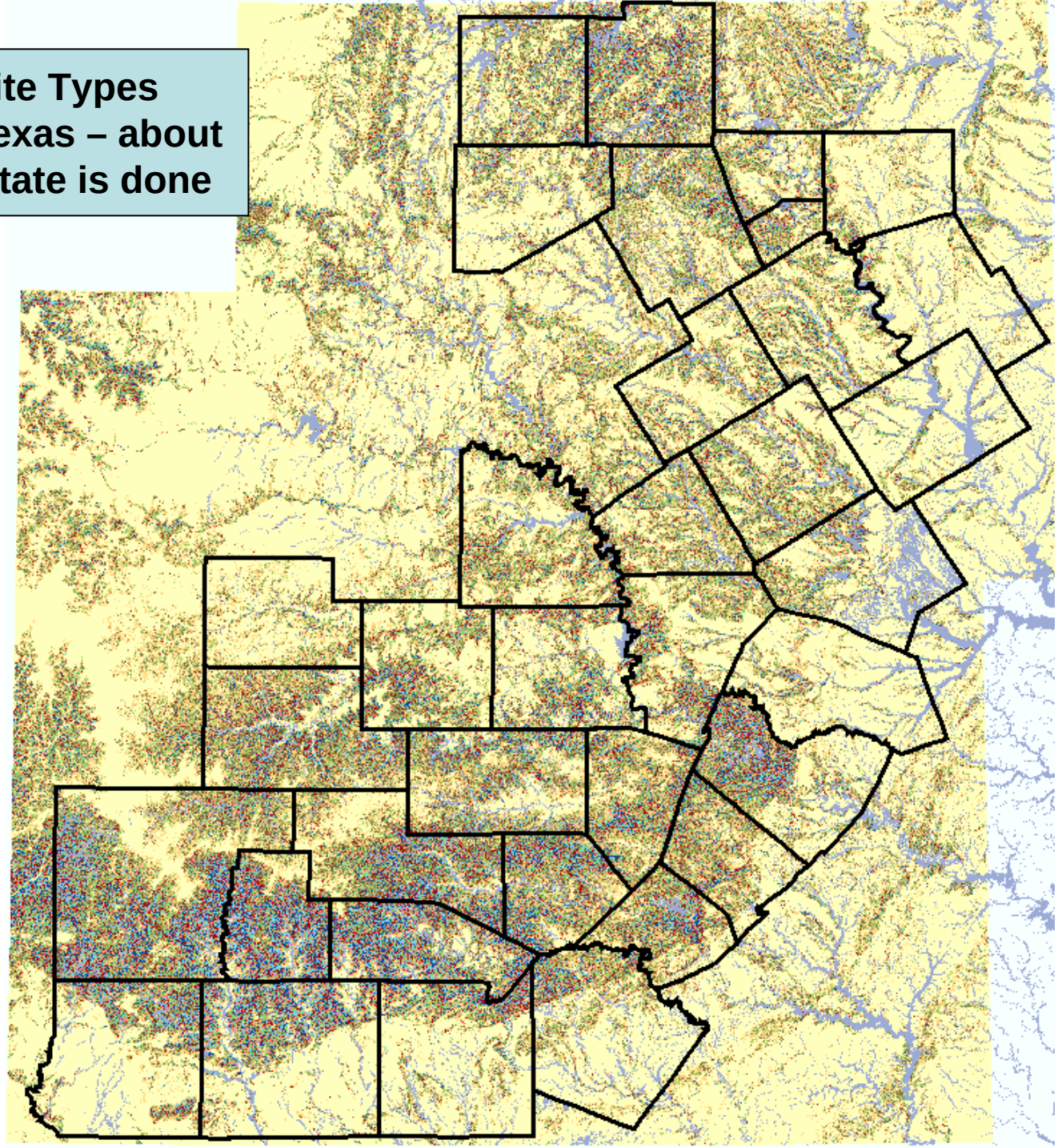
Example: Total relief within the circle is the difference between highest and lowest cell



Some Metrics from DEMs

- Slope (percent)
- Exposure (N, S, E, W)
- Solar Insolation (a function of slope, exposure, and shading)
- Land position (high or low relative to neighbors)
- Relative Moisture Indices (how many pixels drain to and away from a spot, and how fast)
- Land shape (concave, convex)
- The last two are especially sensitive to neighborhood size

Abiotic Site Types for Central Texas – about 1/3rd of the state is done



TEXAS PARKS & WILDLIFE

mlramap - Windows Picture and Fax Viewer

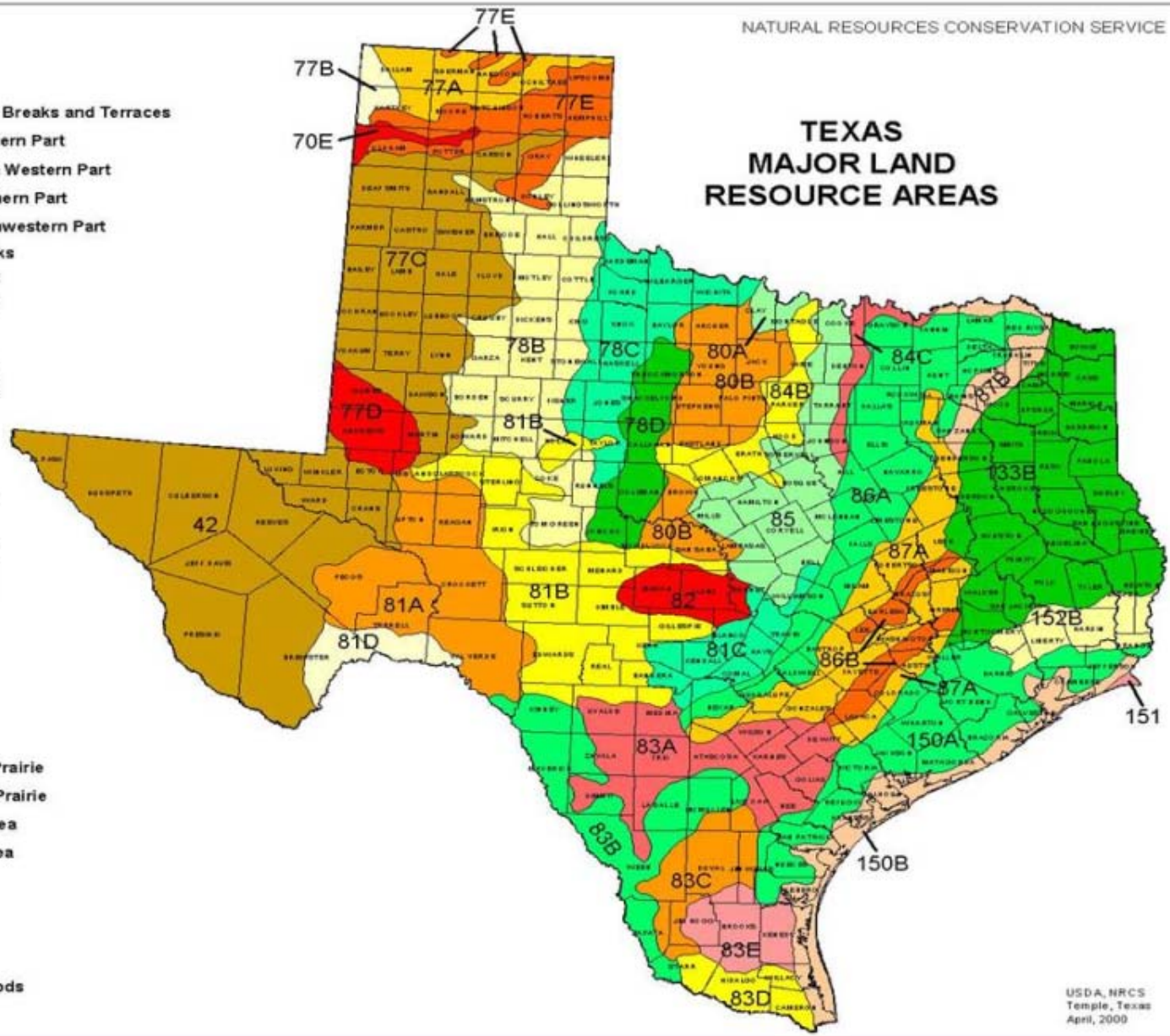
U. S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

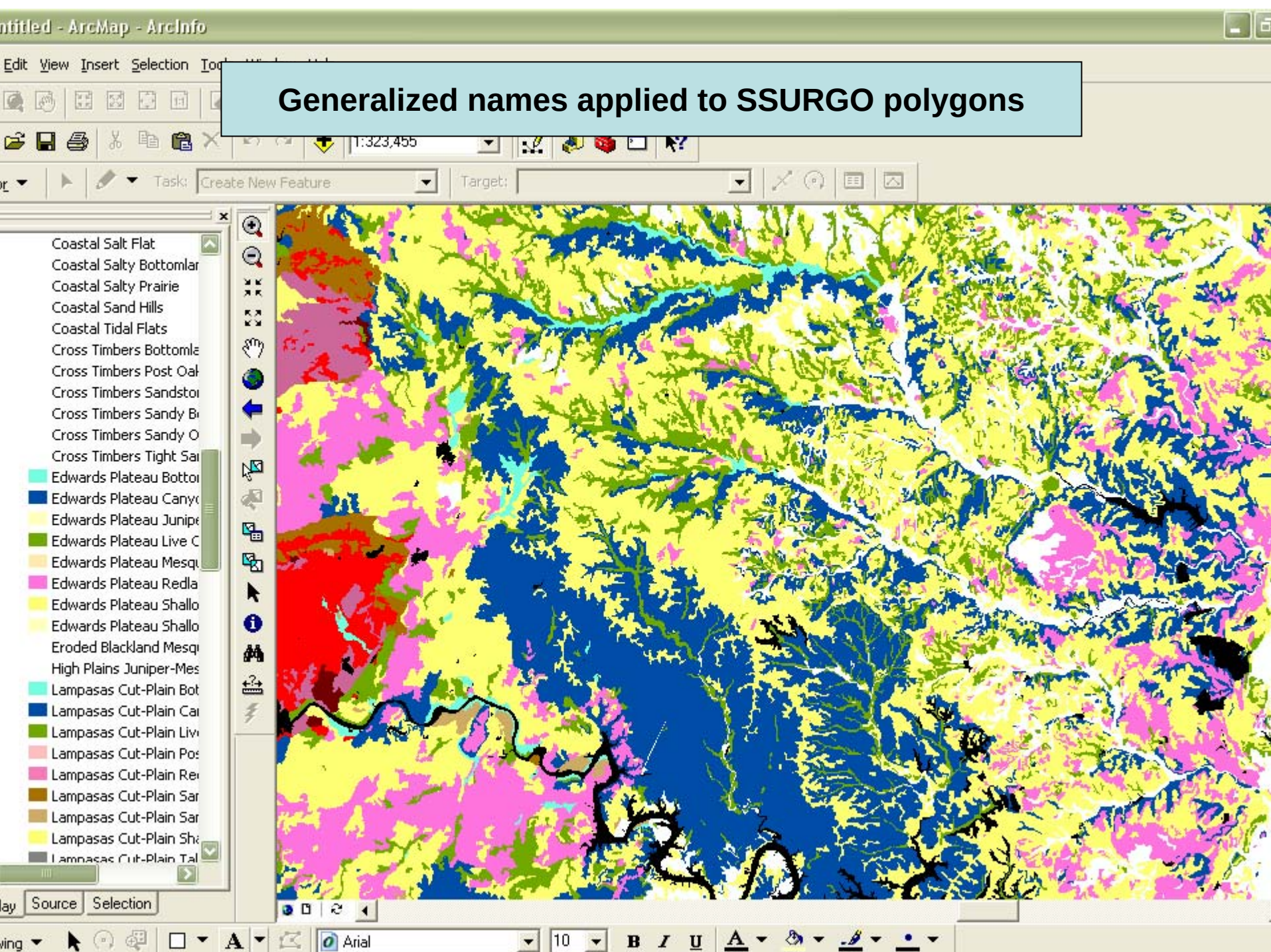
TEXAS MAJOR LAND RESOURCE AREAS

LEGEND

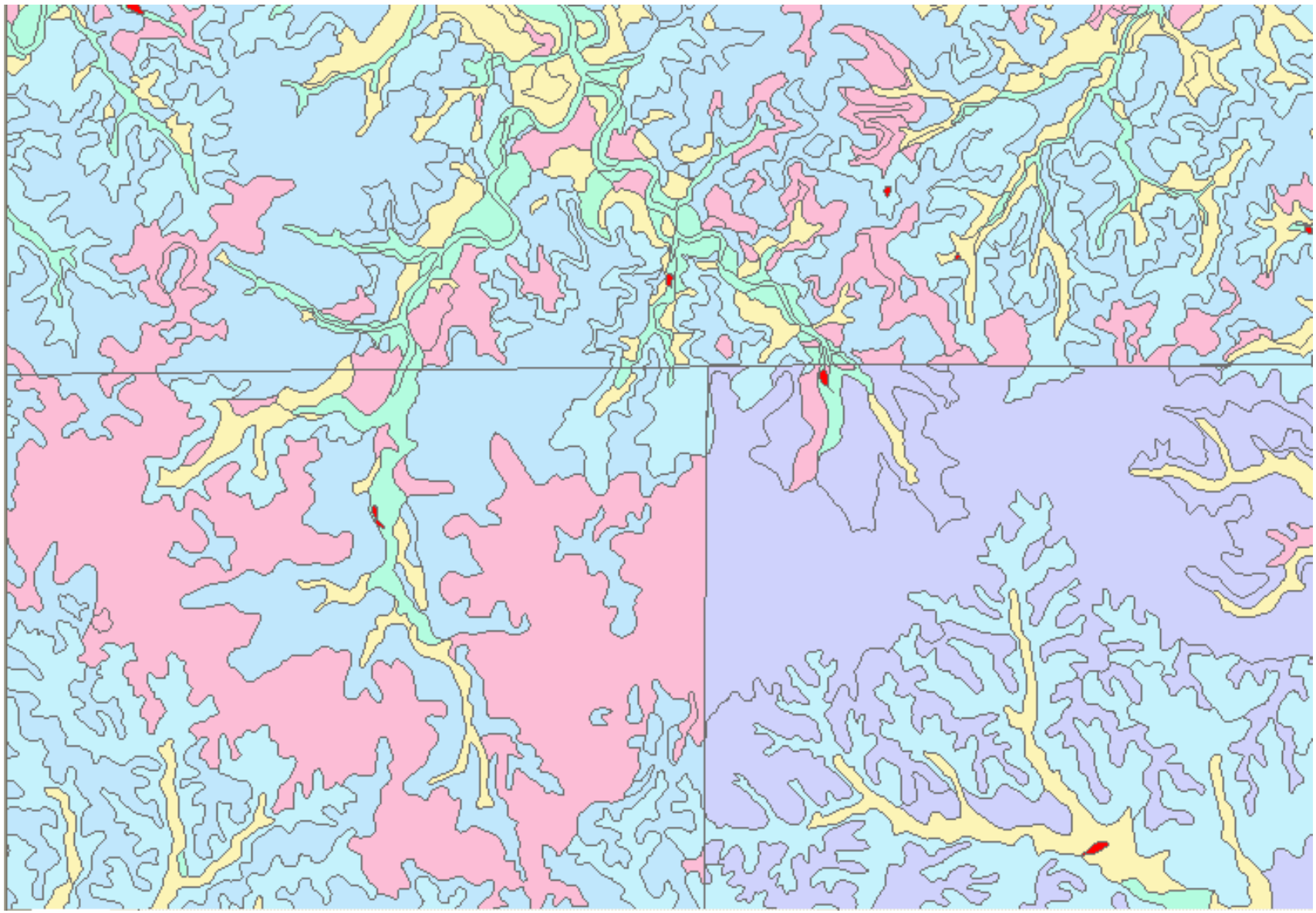
42	Trans-Pecos
70E	Upper Pecos and Canadian Breaks and Terraces
77A	Southern High Plains Northern Part
77B	Southern High Plains North Western Part
77C	Southern High Plains Southern Part
77D	Southern High Plains Southwestern Part
77E	Southern High Plains Breaks
78B	Rolling Plains Western Part
78C	Rolling Plains Eastern Part
78D	Rolling Limestone Prairie
80A	Central Rolling Red Prairie
80B	Texas North Central Prairie
81A	Western Edwards Plateau
81B	Central Edwards Plateau
81C	Eastern Edwards Plateau
81D	Southern Edwards Plateau
82A	Texas Central Basin
83A	Northern Rio Grande Plain
83B	Western Rio Grande Plain
83C	Central Rio Grande Plain
83D	Lower Rio Grande Plain
83E	Sandsheet Prairie
84B	West Cross Timbers
84C	East Cross Timbers
85	Grand Prairie
86A	Northern Texas Blackland Prairie
86B	Southern Texas Blackland Prairie
87A	Southern Texas Claypan Area
87B	Northern Texas Claypan Area
133B	East Texas Timberlands
150A	Gulf Coast Prairie
150B	Gulf Coast Saline Prairie
151	Gulf Coast Marsh
152B	Western Gulf Coast Flatwoods



start
4 Microso...
quotes097...
Document...
PowerMizz...
3 Microso...
Ecological ...
mlramap - ...
11:53 AM

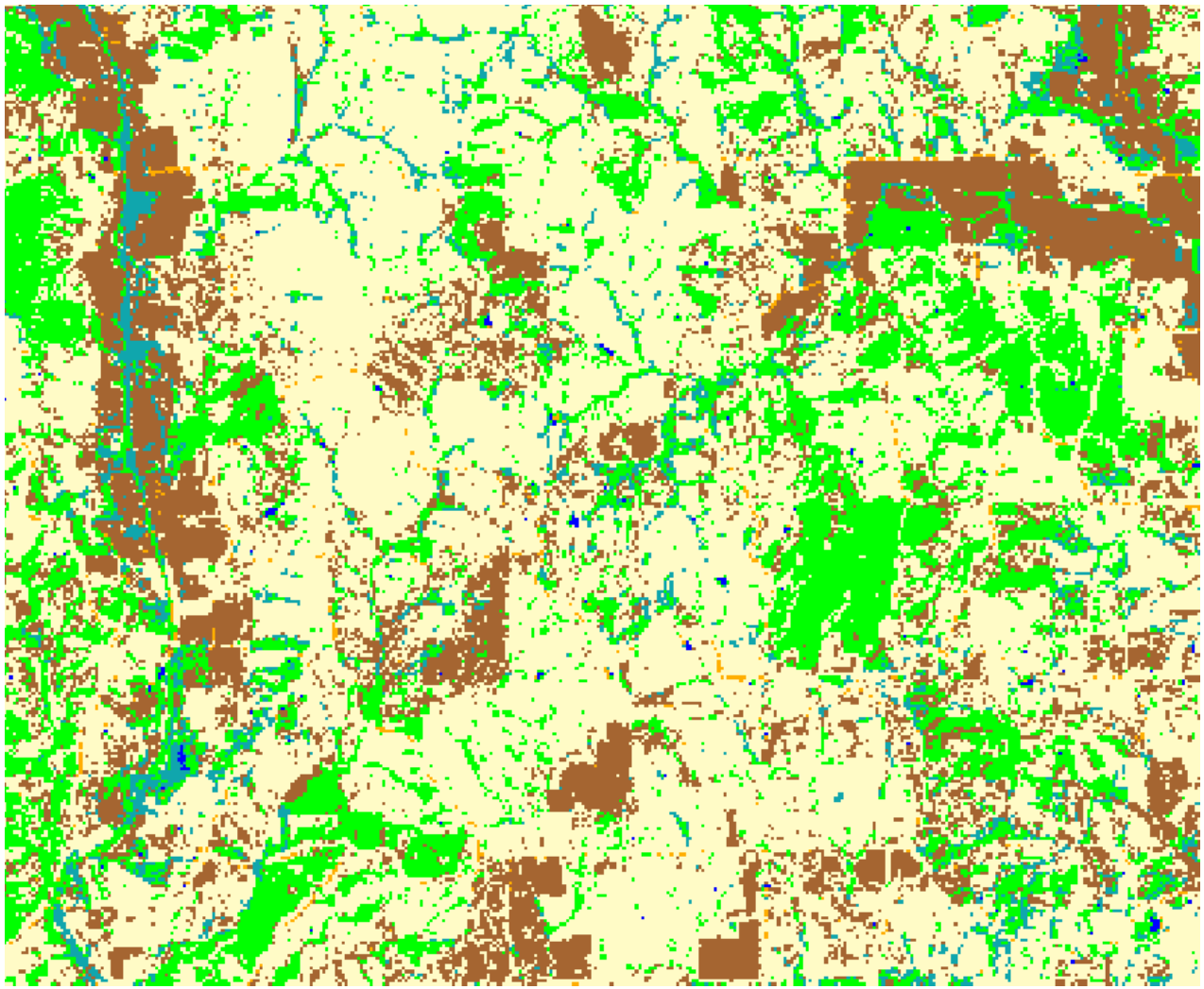

Generalized names applied to SSURGO polygons
ntitled - ArcMap - ArcInfo
Edit View Insert Selection
1:323,455
Task: Create New Feature
Target:
Coastal Salt Flat
Coastal Salty Bottomlar
Coastal Salty Prairie
Coastal Sand Hills
Coastal Tidal Flats
Cross Timbers Bottomla
Cross Timbers Post Oak
Cross Timbers Sandstor
Cross Timbers Sandy B
Cross Timbers Sandy O
Cross Timbers Tight Sa
Edwards Plateau Botto
Edwards Plateau Canyo
Edwards Plateau Junipe
Edwards Plateau Live C
Edwards Plateau Mesqu
Edwards Plateau Redla
Edwards Plateau Shallo
Edwards Plateau Shallo
Eroded Blackland Mesq
High Plains Juniper-Mes
Lampasas Cut-Plain Bot
Lampasas Cut-Plain Ca
Lampasas Cut-Plain Liv
Lampasas Cut-Plain Pos
Lampasas Cut-Plain Re
Lampasas Cut-Plain Sar
Lampasas Cut-Plain Sar
Lampasas Cut-Plain Sha
Source
Selection
Arial
10

County Edge Matching: a common problem



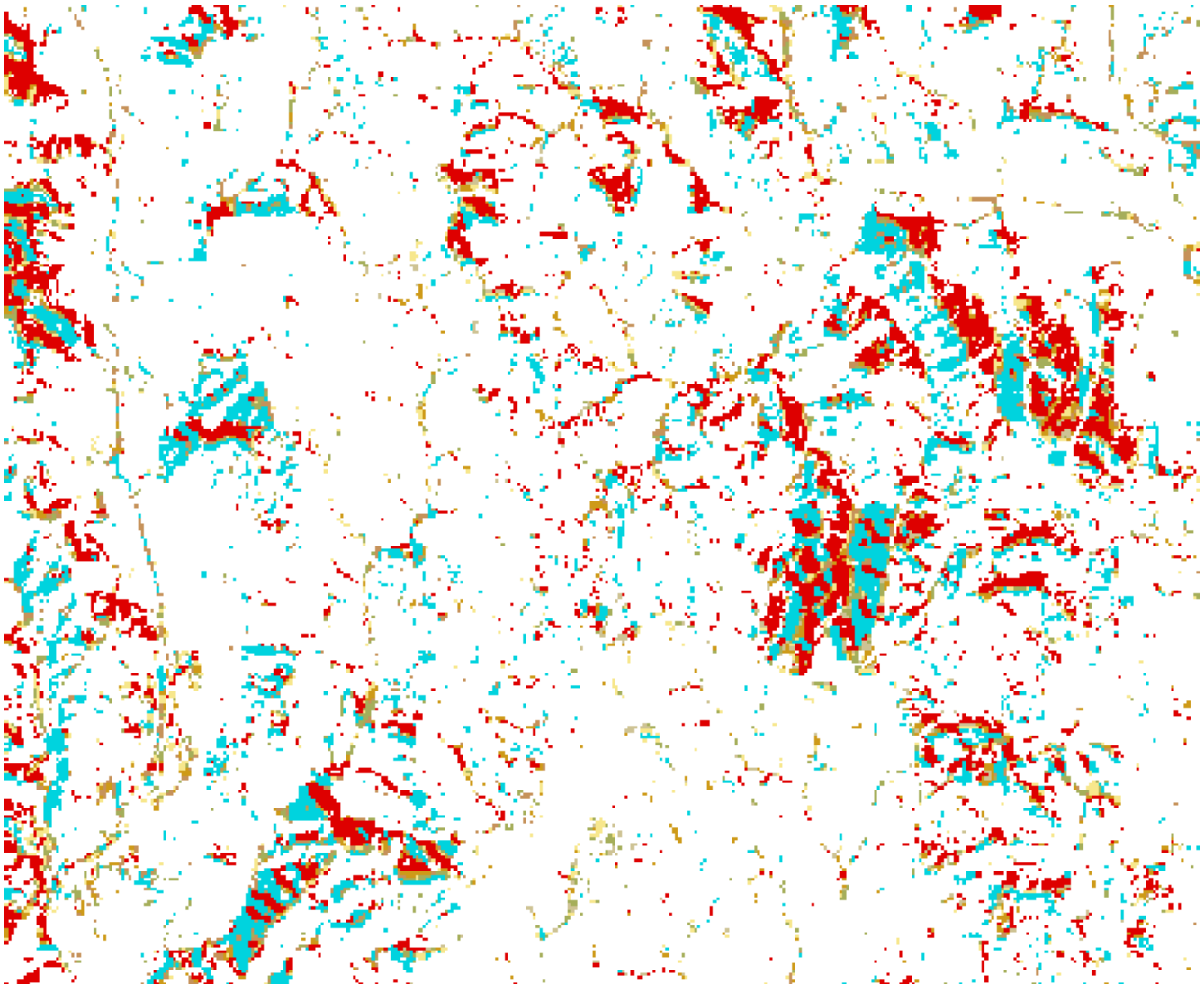
The upshot: abiotic variables & soils can be used to help model current vegetation (e.g. ecological systems)

NLCD Land Cover: Forest, Grassland, Cropland



The upshot: abiotic variables can be used to model current vegetation (e.g. ecological systems)

Forest Habitat: Mesic Forest versus Dry Forest



Field data collection will provide input for classification and accuracy assessment.
All field data collection will be coordinated by TPWD

Mapping Ecological Systems: Selection of a Method

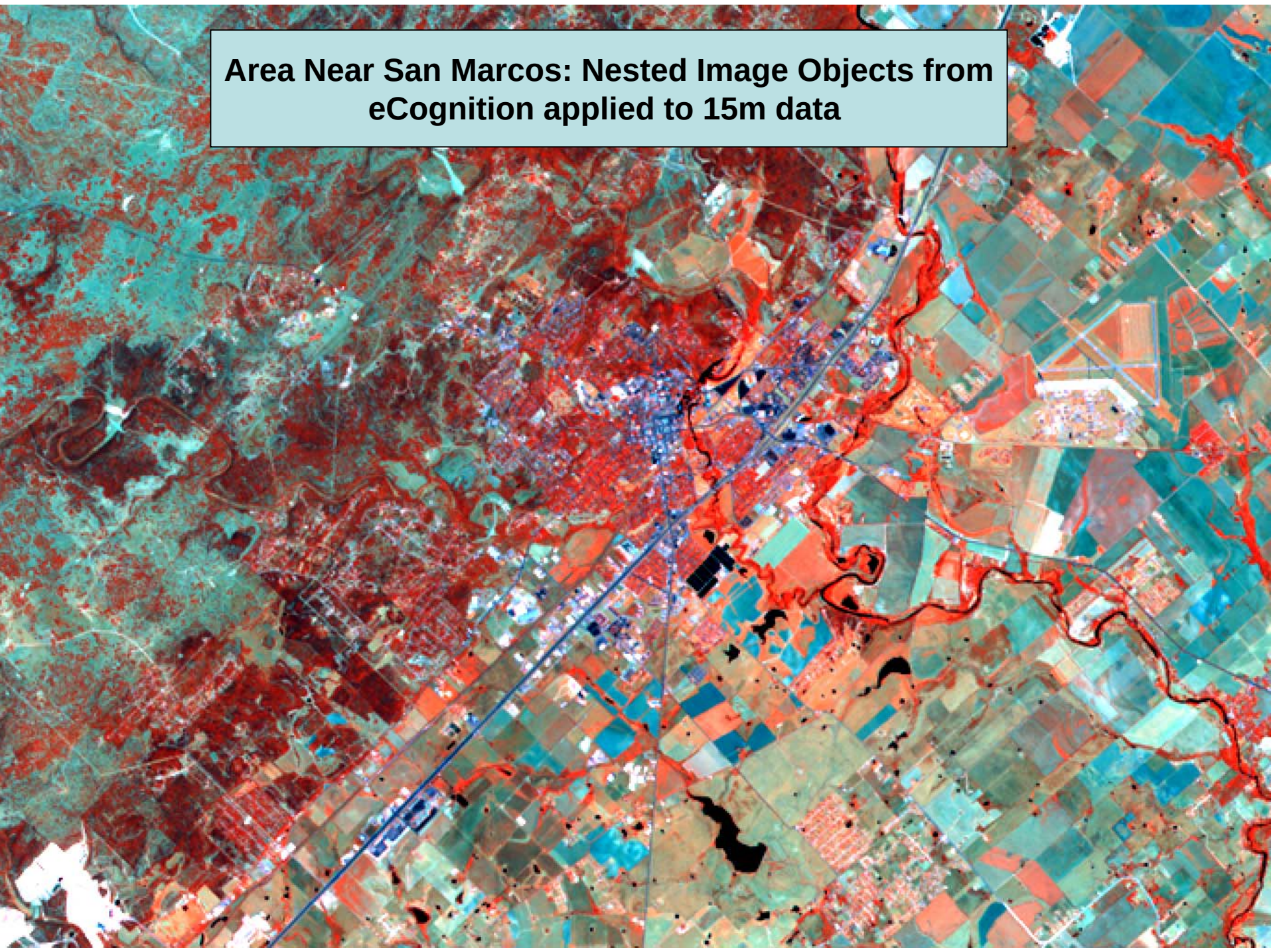
- Direct classification by including reflectance data from imagery together with environmental variables
- Indirect modeling by overlaying land cover results from classification of reflectance data with environmental data (soils and abiotic site types)

Likely Methodology & Reasoning

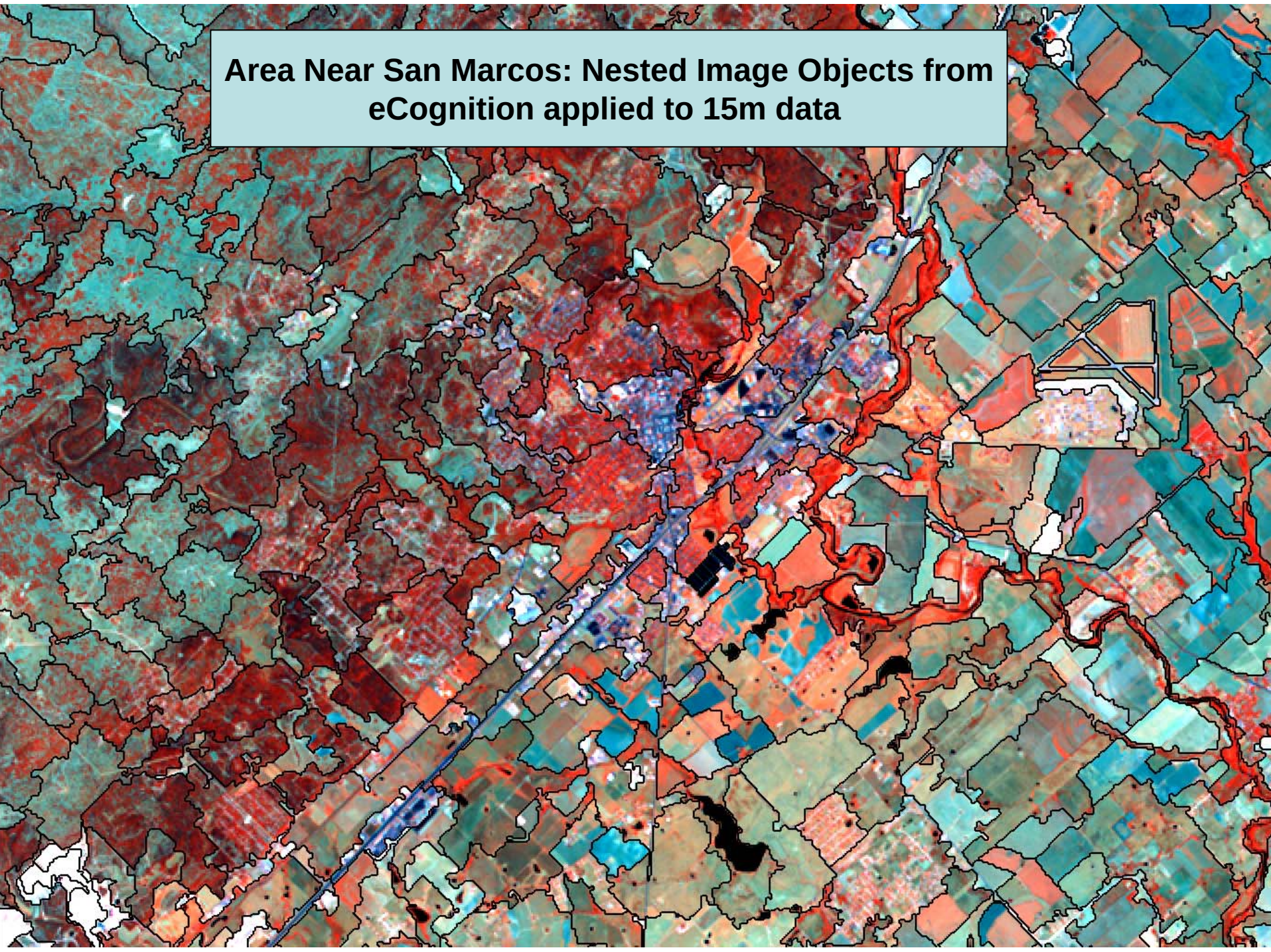
- Use satellite imagery for initial classification of land cover, and model target ecological systems using abiotic data ‘after classification’
  - Collection of appropriate ground data for direct classification would mean targeting at least 150 samples of each land cover type on each soil type or abiotic site type – a difficult logistical problem
- We may be able to develop a ‘mask’ for major land cover types and then classify directly using reflectance & abiotic data in Decision Trees
- A combination of methods may be needed to classify target ecological systems

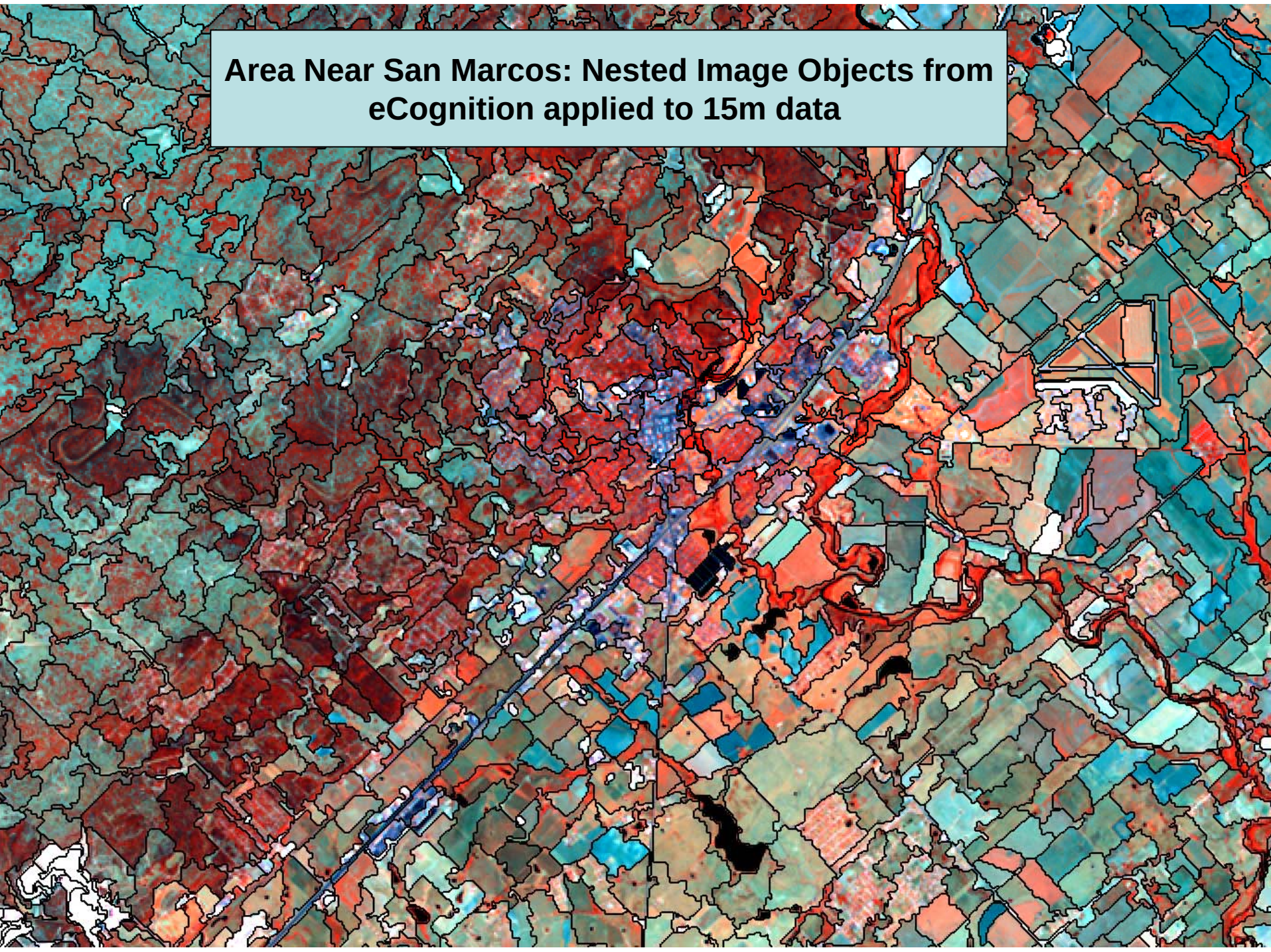
Dealing with Large File Size: A Possible Solution

- As the pixel size of the imagery decreases, the file size increases
  - Going from 30m to 15m (TM-Pan merge) increases file size by a factor of four
  - Going from 30m to 10m (TM-SPOT merge) increases file size by a factor of nine
- Processing time increases as the size of the input file increases (30 bands for one scene occupies about 30 gigabytes)
- Software limitations may also be an issue
- File sizes should be kept as small as possible and still achieve desired results
- Possible solution: process 30m resolution data, and achieve mmu requirements from eCognition applied to finer resolution data

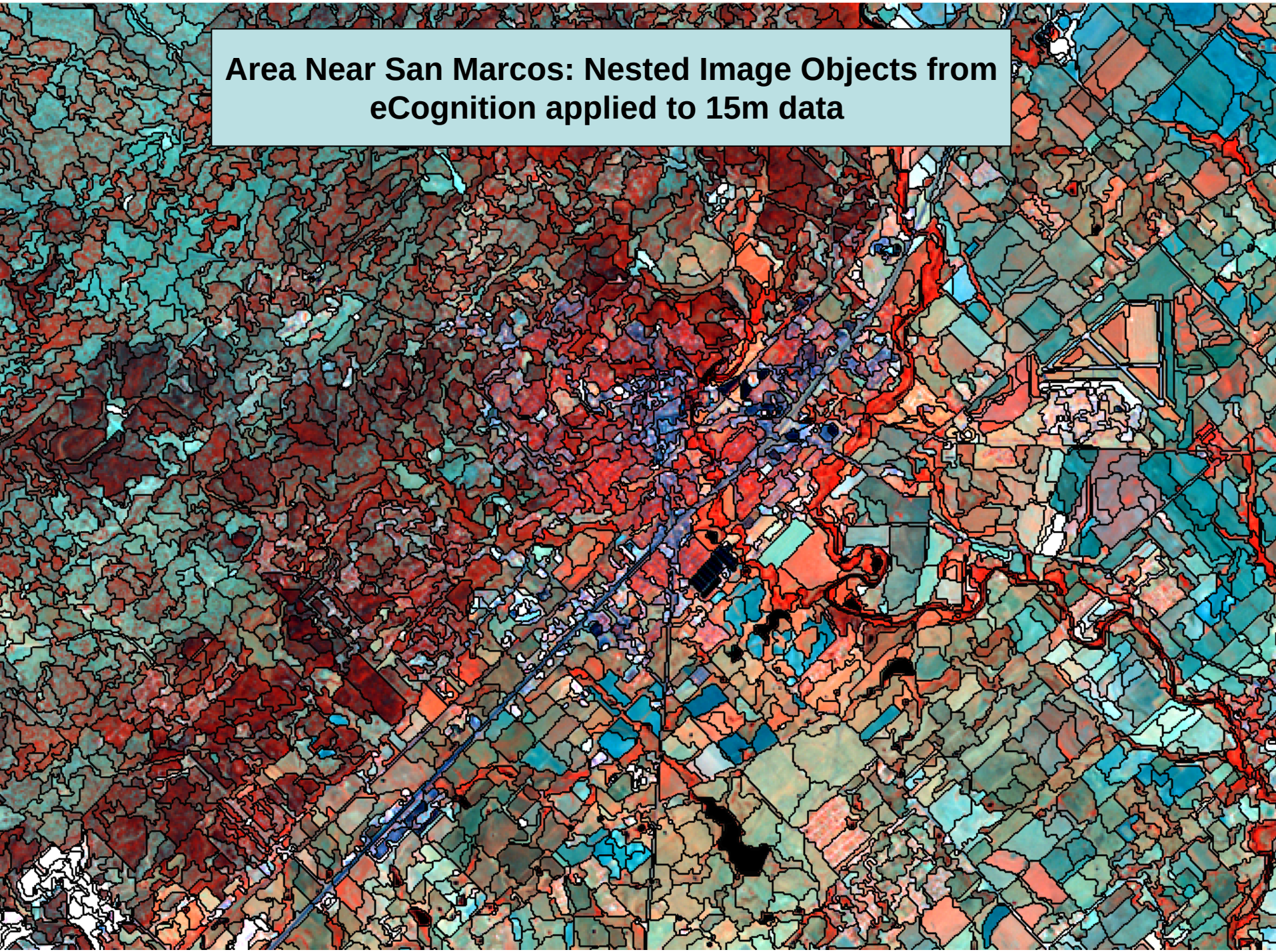

Area Near San Marcos: Nested Image Objects from eCognition applied to 15m data

Area Near San Marcos: Nested Image Objects from eCognition applied to 15m data

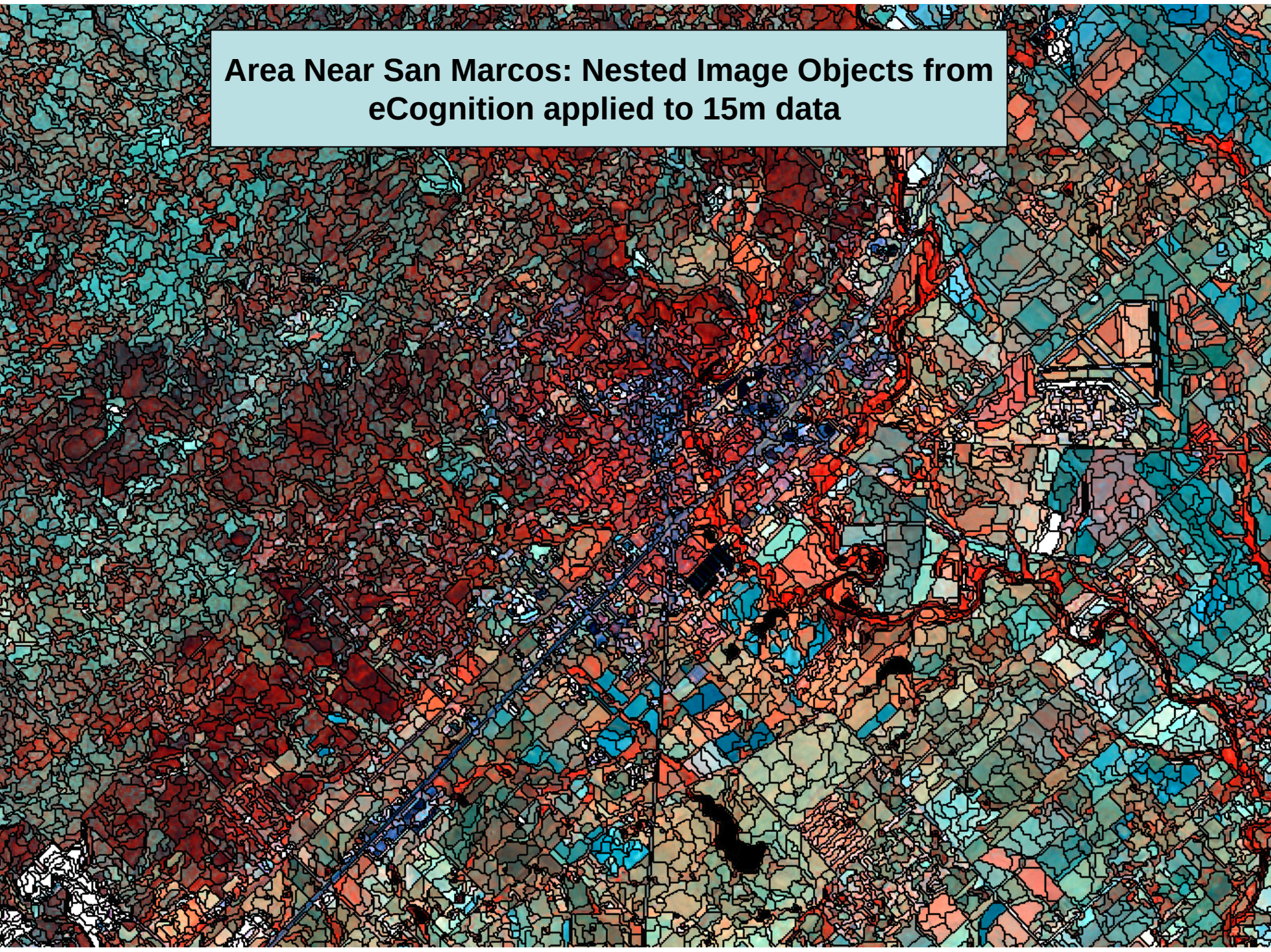



Area Near San Marcos: Nested Image Objects from eCognition applied to 15m data

Area Near San Marcos: Nested Image Objects from eCognition applied to 15m data



Area Near San Marcos: Nested Image Objects from eCognition applied to 15m data



Contact: David Diamond or
Clayton Blodgett, MoRAP
or
Duane German, Texas Parks & Wildlife