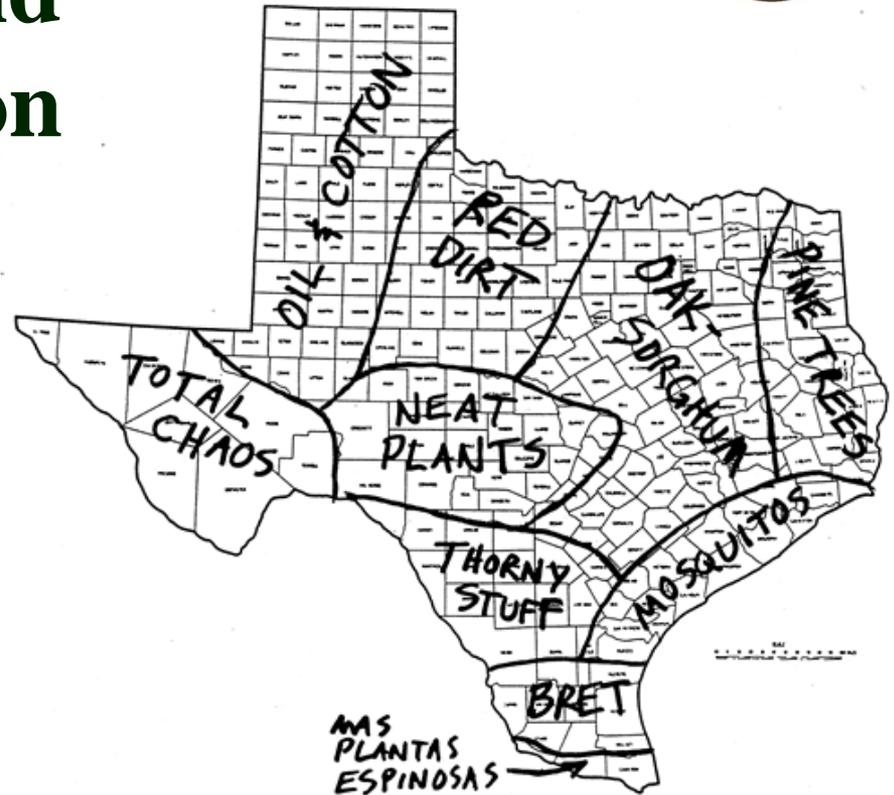




Mapping Vegetation at a Higher Spatial and Thematic Resolution

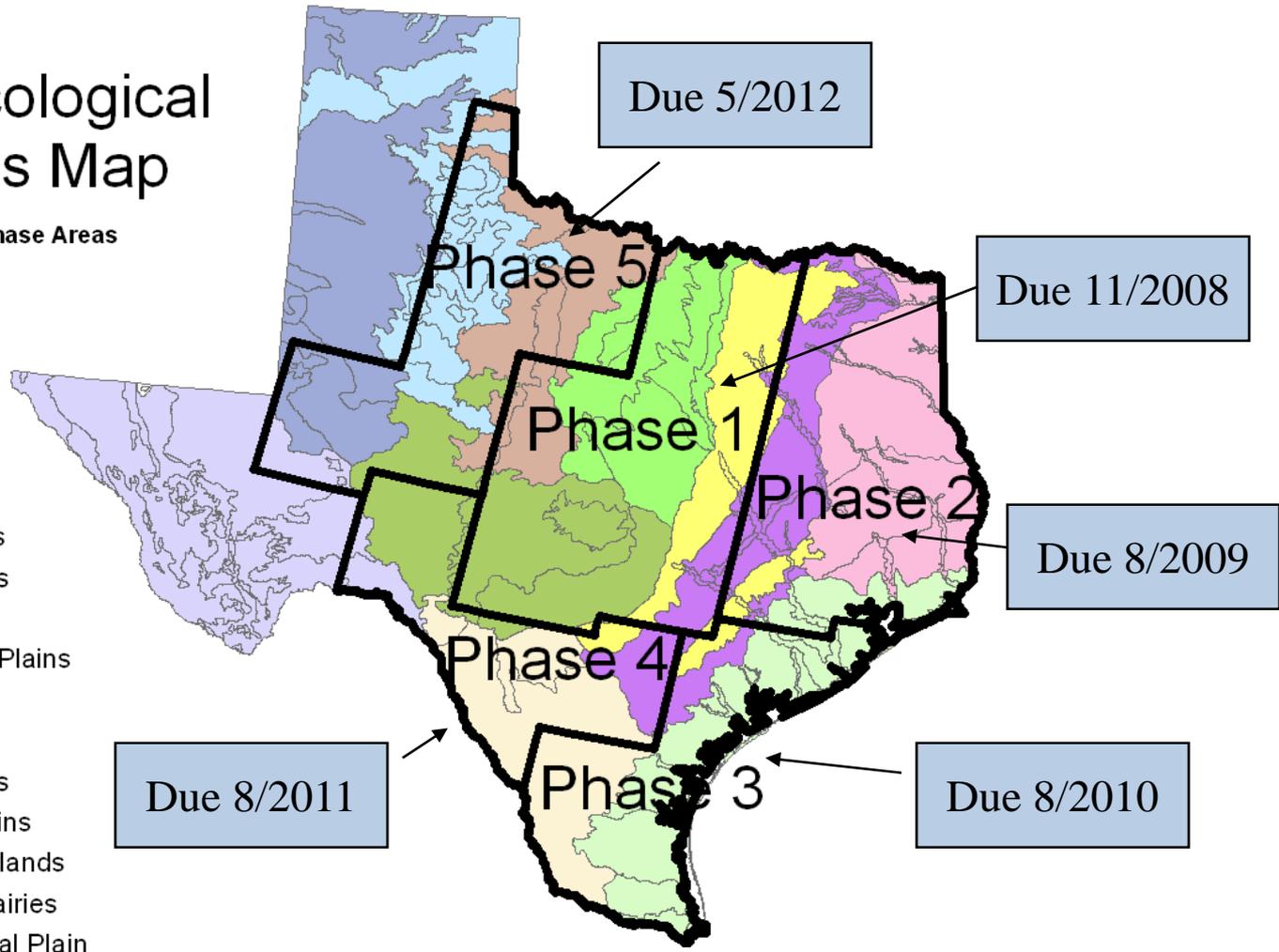


Texas Ecological Systems Map

Proposed Phase Areas

Ecoregion

- Central Great Plains
- Chihuahuan Deserts
- Cross Timbers
- East Central Texas Plains
- Edwards Plateau
- High Plains
- South Central Plains
- Southern Texas Plains
- Southwestern Tablelands
- Texas Blackland Prairies
- Western Gulf Coastal Plain



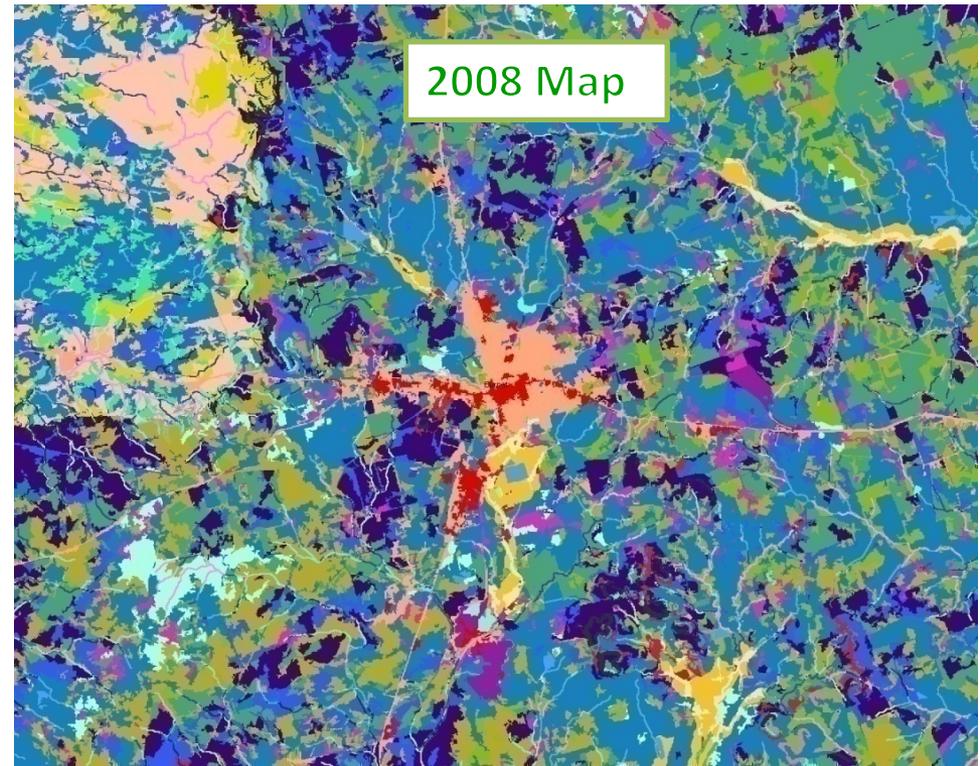
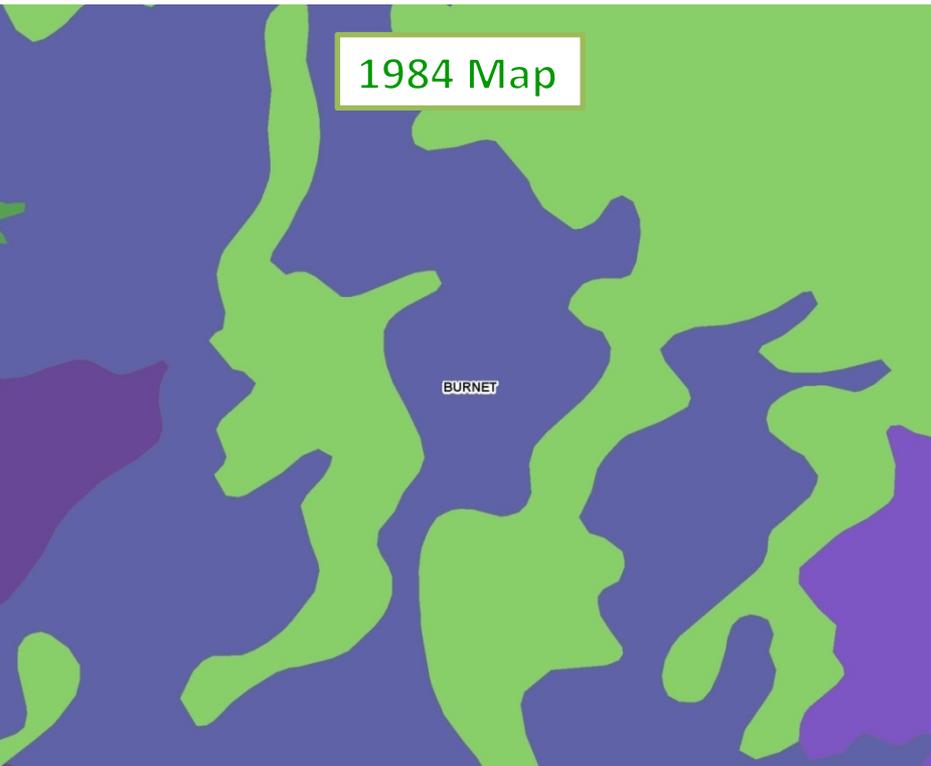
Overview of today's talk

1. What are we mapping?
2. How are we collecting ground data?
3. How are we mapping land cover?
4. How are we modeling ecological subsystems?
5. What are the products?



1. What are we mapping?

- Higher spatial resolution
- More land cover classes
- Better accuracy (overall 85%)



Ecological Systems & Subsystems

- Assemblage of plant species
- Similar environmental conditions
 - Landscape location
 - Soil
 - Geology
 - Climate
 - Hydrology
 - Etc....



Subsystem Example

Final Keys for GIS P1 Feb2 09.xlsx - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Acrobat

Clipboard Font Alignment Number Styles Cells Editing

B7 Agriculture and other Human-related, Azonal Subsystems

	A	B	C	D
1	SystemCode	Ecol_System	Map_Subst	Common_Name
2	CES205.896	Bastrop Lost Pines Forest and Woodland	Bastrop Lost Pines Loblolly Pine Forest and Woodland	Bastrop Lost Pines: Loblolly Pine Forest
3		Bastrop Lost Pines Forest and Woodland	Bastrop Lost Pines Loblolly Pine-Oak Forest and Woodland	Bastrop Lost Pines: Loblolly Pine / Oak Forest
4		Bastrop Lost Pines Forest and Woodland	Bastrop Lost Pines Loblolly Pine Slope Forest	Bastrop Lost Pine: Loblolly Pine Slope Forest
5		Bastrop Lost Pines Forest and Woodland	Bastrop Lost Pines Loblolly Pine-Oak Slope Forest	Bastrop Lost Pines: Loblolly Pine / Oak Slope Forest
6		Bastrop Lost Pines Forest and Woodland	Bastrop Lost Pines Deciduous Slope Forest	Bastrop Lost Pines: Hardwood Slope Forest
7		Agriculture and other Human-related, Azonal Subsystems	Blackland Prairie Disturbance or Tame Grassland	Blackland Prairie: Disturbance or Tame Grassland
8	CES303.659	Central Mixedgrass Prairie	Central Mixedgrass Prairie	Rolling Plains: Mixedgrass Prairie
9	CES302.746	Chihuahuan-Sonoran Desert Bottomland and Swale Grassland	Tobosa Grassland	Southwest: Tobosa Grassland
10		Crosstimbers Oak Forest and Woodland	Crosstimbers Live Oak Forest and Woodland	Crosstimbers: Live Oak Forest and Woodland
11		Crosstimbers Oak Forest and Woodland	Crosstimbers Post Oak-Juniper Forest and Woodland	Crosstimbers: Post Oak / Juniper Woodland
12	CES205.682	Crosstimbers Oak Forest and Woodland	Crosstimbers Post Oak Forest and Woodland	Crosstimbers: Post Oak Woodland
13		Crosstimbers Oak Forest and Woodland	Crosstimbers Savanna Grassland	Crosstimbers: Savanna Grassland
14		Crosstimbers Oak Forest and Woodland	Crosstimbers Juniper Slope Forest	Crosstimbers: Juniper Slope Forest
15		Crosstimbers Oak Forest and Woodland	Crosstimbers Deciduous-Juniper Slope Forest	Crosstimbers: Hardwood / Juniper Slope Forest
16		Crosstimbers Oak Forest and Woodland	Crosstimbers Deciduous Slope Forest	Crosstimbers: Oak / Hardwood Slope Forest
17		Crosstimbers Oak Forest and Woodland	Crosstimbers Sandyland Oak Woodland	Crosstimbers: Sandyland Oak Woodland
18		East-Central Texas Plains Post Oak Savanna and Woodland	East-Central Texas Plains Live Oak Motte and Woodland	Post Oak Savanna: Live Oak Motte and Woodland

Ecol Sys & Subsys Names & Codes Hist Veg to Abiotic Sites Key Historic Veg to Soils Key Soils to Land Cover Key

2. How are we collecting ground data?

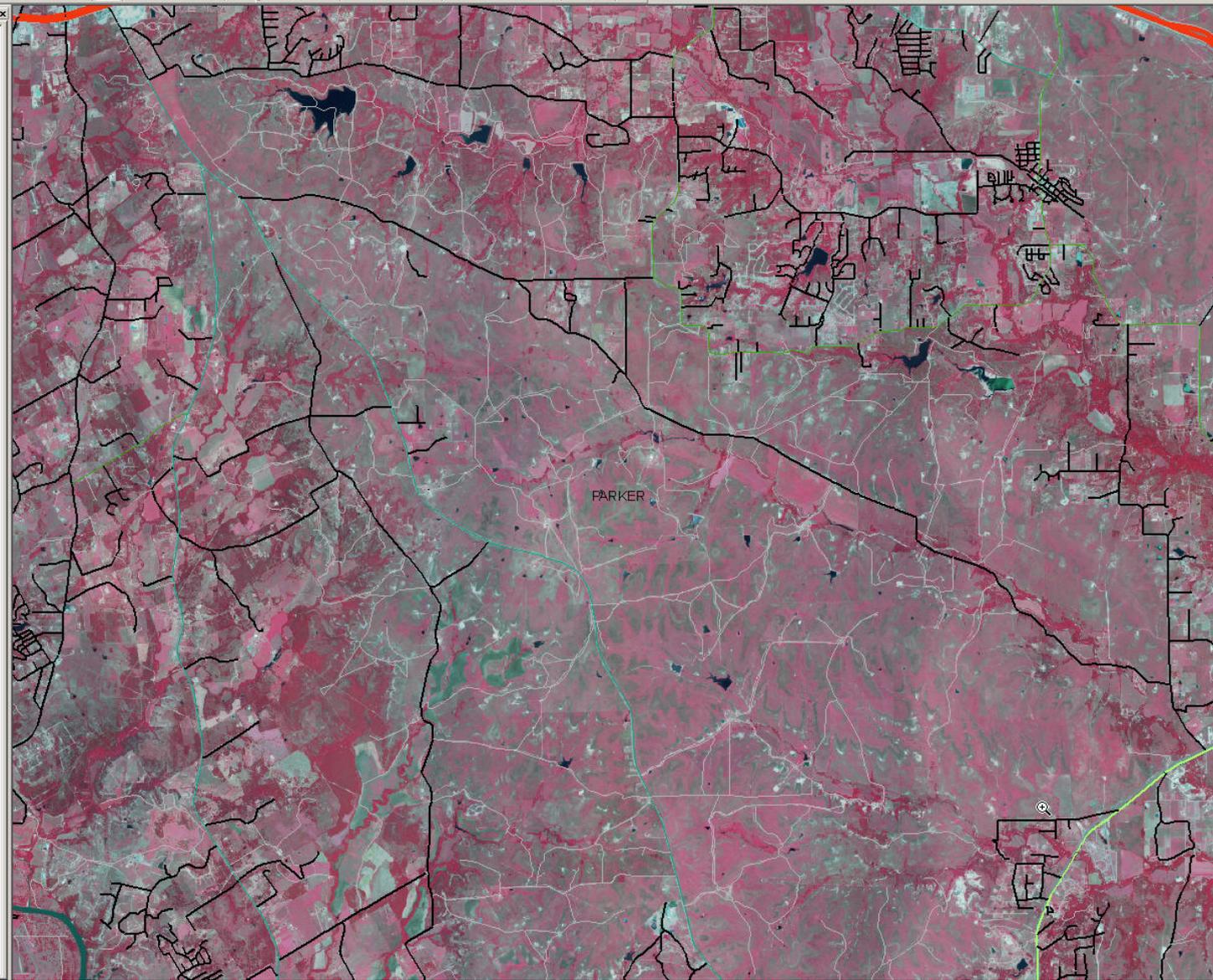
Field data collection provides
Input for classification and
accuracy assessment.

- Most data collected adjacent to public roads and public lands.
 - Private land data only with written permission
 - Sample sites
 - Minimum of 1 mile apart, except when rare systems are encountered
 - Minimum of 30 meters from the roadway
 - 1 hectare homogenous community



Layers

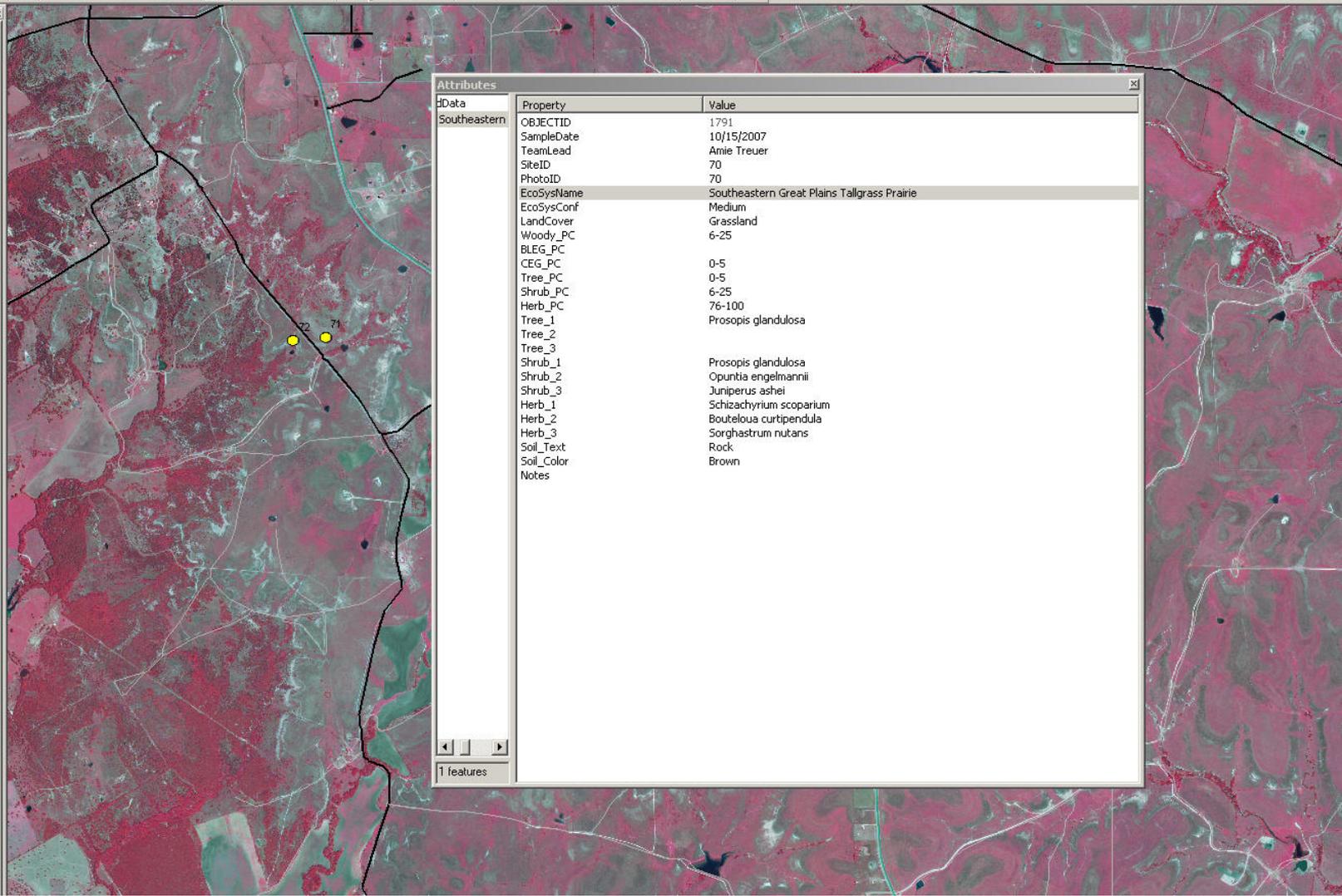
- FieldData
- PineSoils
- ESDwHisVeg
- MappingPhase_1_CntyBnd
- MappingPhase_1_TigerRd
 - Rd_Type
 - CRd
 - FMRd
 - IH
 - MajRd
 - MinorRd
 - PriRd
 - RRd
 - SH
 - US
 - UnkRd
- MappingPhase_1_Bnd
- GeologyP1
- phase1_cen.img
 - RGB
 - Red: Layer_3
 - Green: Layer_2
 - Blue: Layer_1
- naip_1-1_1c_s_bx021_2004_1.sid
 - RGB
 - Red: Band_1
 - Green: Band_2
 - Blue: Band_3
- naip_1-1_1c_s_bx367_2004_1.sid
 - RGB
 - Red: Band_1
 - Green: Band_2
 - Blue: Band_3
- p1_comm_eo
- MRLAdata_Clip
 - MRLANAME
 - Central Rolling Red Plains
 - Central Rolling Red Prairies
 - East Cross Timbers
 - Edwards Plateau
 - Grand Prairie
 - Northern Rio Grande Plain
 - Texas Blackland Prairie
 - Texas Central Basin
 - Texas Claypan Area
 - Texas North-Central Prairies
 - West Cross Timbers
 - Western Coastal Plain





Layers

- FieldData
- PineSoils
- ESDwHisVeg
- MappingPhase_1_CntyBnd
- MappingPhase_1_TigerRd
 - Rd_Type
 - CRd
 - FMRd
 - IH
 - MajRd
 - MinorRd
 - PriRd
 - RRd
 - SH
 - US
 - UnkRd
- MappingPhase_1_Bnd
- GeologyP1
- phase1_cen.img
 - RGB
 - Red: Layer_3
 - Green: Layer_2
 - Blue: Layer_1
- naip_1-1_1c_s_tx021_2004_1.sid
 - RGB
 - Red: Band_1
 - Green: Band_2
 - Blue: Band_3
- naip_1-1_1c_s_tx367_2004_1.sid
 - RGB
 - Red: Band_1
 - Green: Band_2
 - Blue: Band_3
- p1_comm_eo
- MRLAdata_Clip
 - MLRANAME
 - Central Rolling Red Plains
 - Central Rolling Red Prairies
 - East Cross Timbers
 - Edwards Plateau
 - Grand Prairie
 - Northern Rio Grande Plain
 - Texas Blackland Prairie
 - Texas Central Basin
 - Texas Claypan Area
 - Texas North-Central Prairies
 - West Cross Timbers



Attributes

IData	Property	Value
Southeastern	OBJECTID	1791
	SampleDate	10/15/2007
	TeamLead	Amie Treuer
	SiteID	70
	PhotoID	70
	EcoSysName	Southeastern Great Plains Tallgrass Prairie
	EcoSysConf	Medium
	LandCover	Grassland
	Woody_PC	6-25
	BLEG_PC	
	CEG_PC	0-5
	Tree_PC	0-5
	Shrub_PC	6-25
	Herb_PC	76-100
	Tree_1	Prosopis glandulosa
	Tree_2	
	Tree_3	
	Shrub_1	Prosopis glandulosa
	Shrub_2	Opuntia engelmannii
	Shrub_3	Juniperus ashei
	Herb_1	Schizachyrium scoparium
	Herb_2	Bouteloua curtipendula
	Herb_3	Sorghastrum nutans
	Soil_Text	Rock
	Soil_Color	Brown
	Notes	

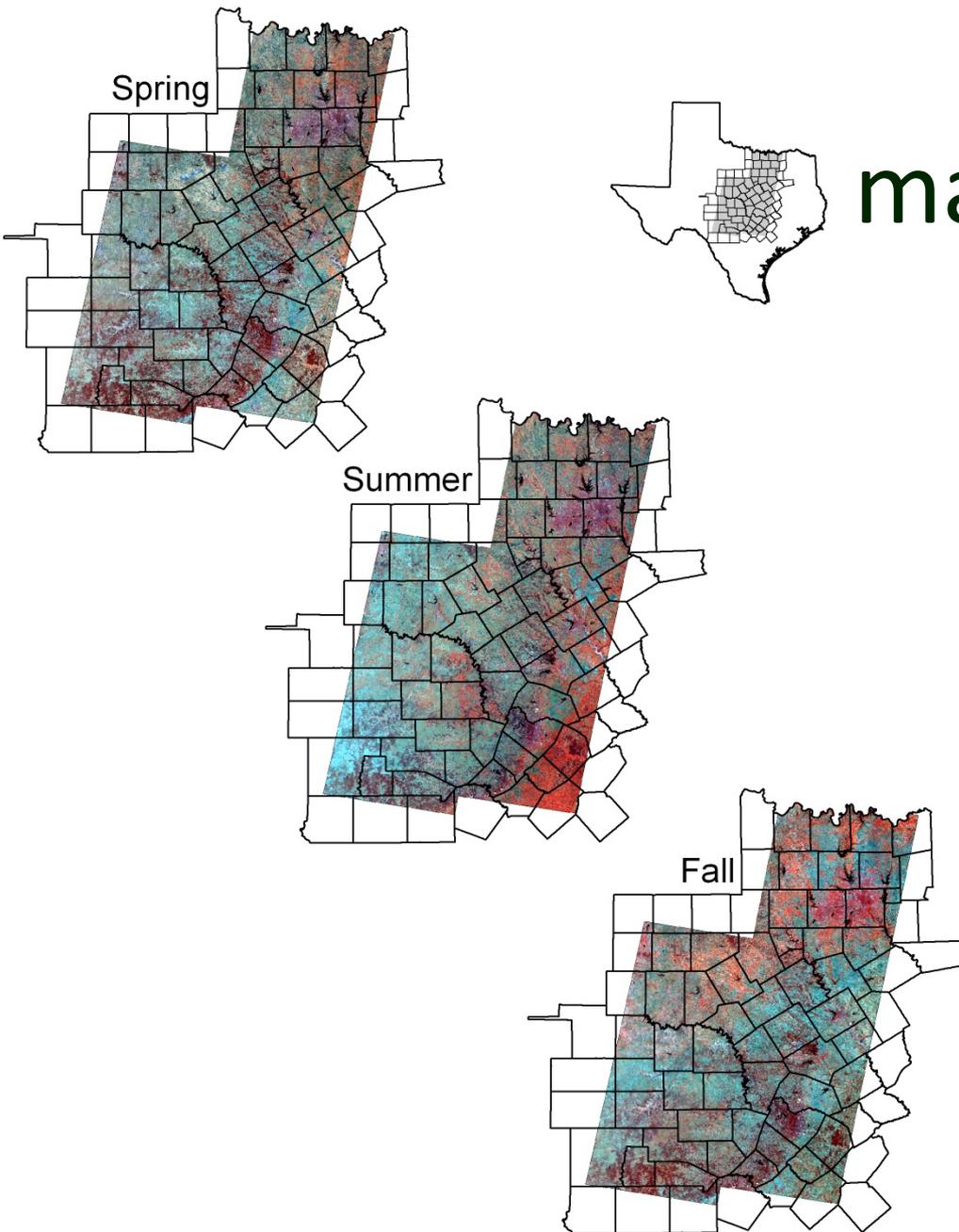
1 features

Field Methods

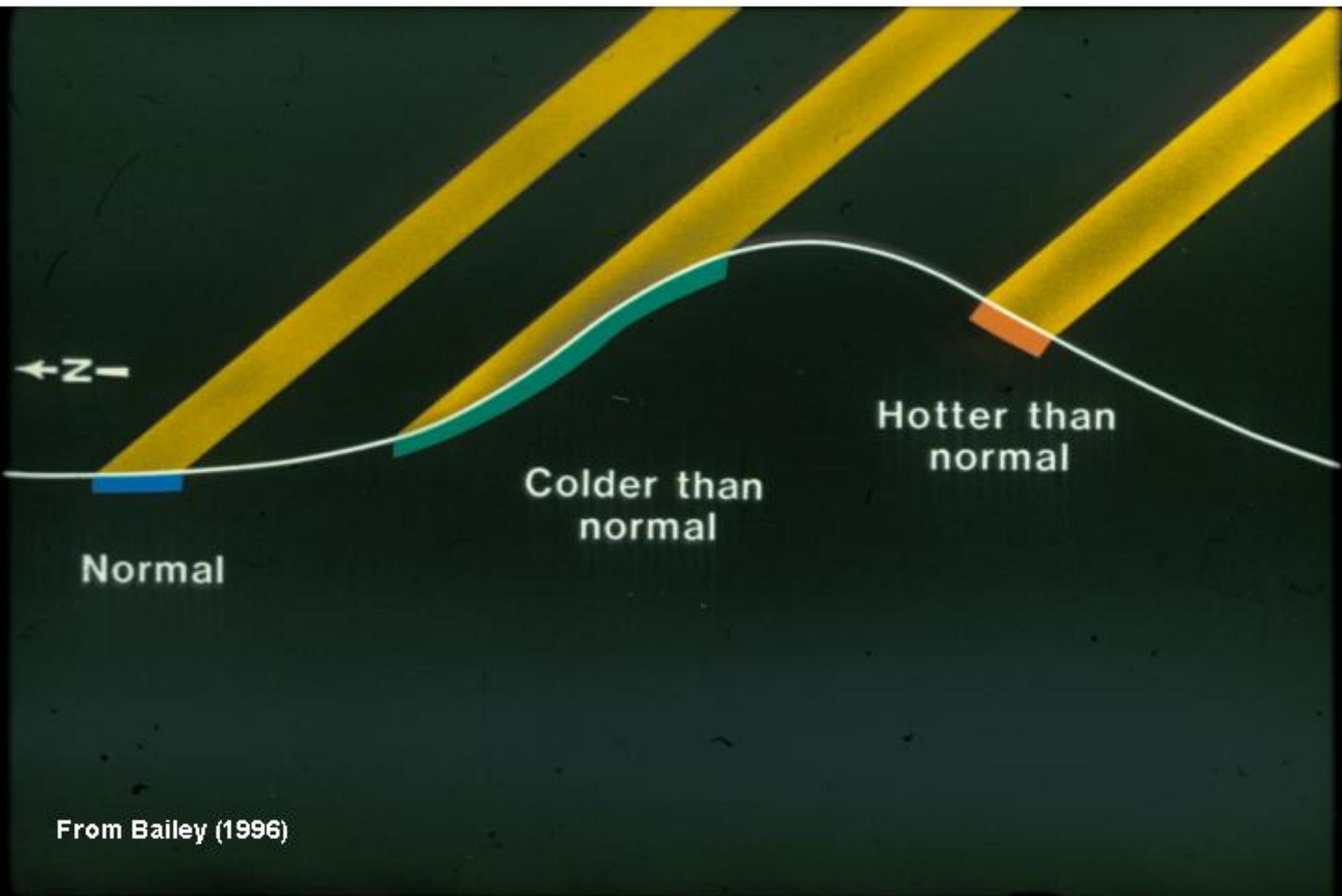
- Benefits
 - Efficient
 - Large amount of data(2927 Data Points in Phase 1 available for other mapping projects)
- Limitations
 - Visibility
 - Land access



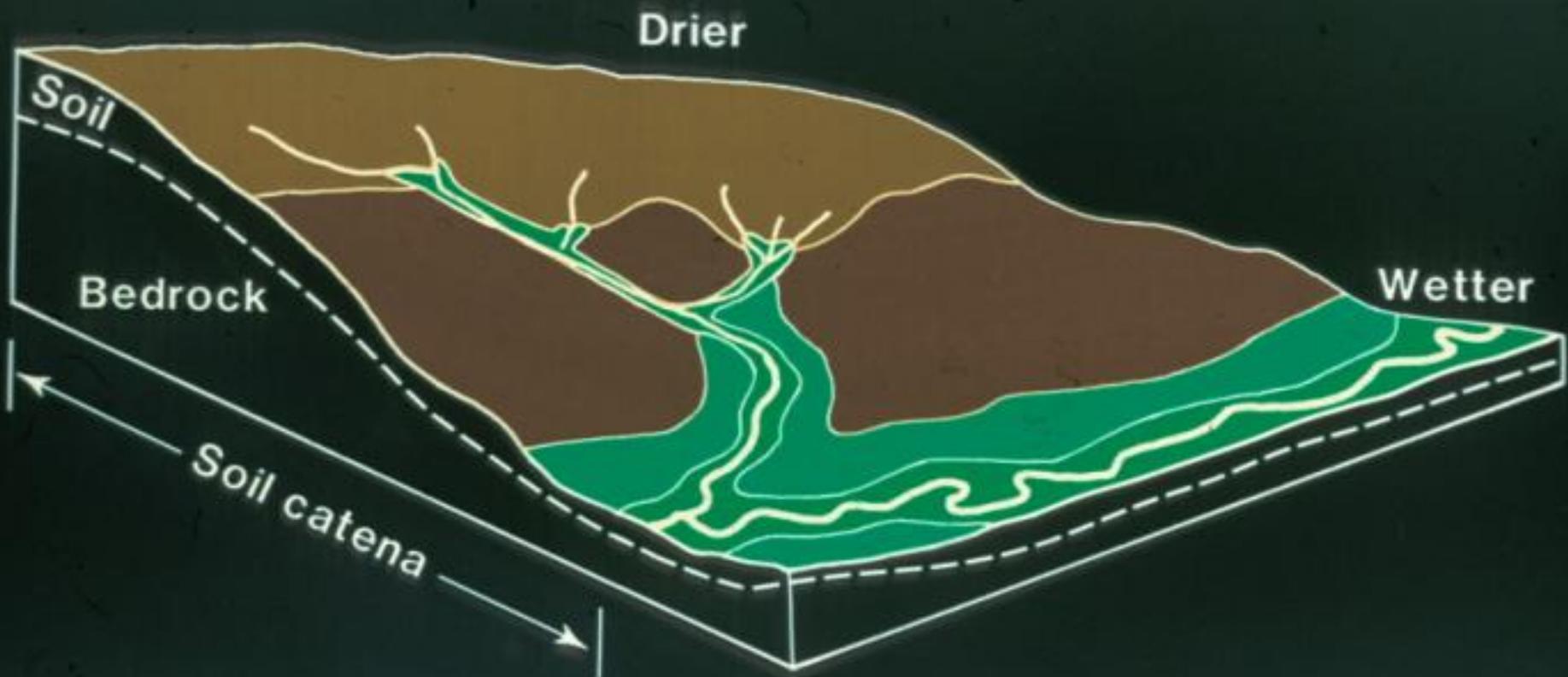
3. How are we mapping land cover?



- Many drafts produced (>30)
- Decision Tree Classifier used
- Continuous as well as categorical data used
 - 3-date TM imagery mosaic,
 - elevation,
 - slope,
 - aspect,
 - CLUs,
 - %canopy,
 - %impervious,
 - solar insolation, &
 - landscape position
- 8099 training points (91% accuracy for those points)

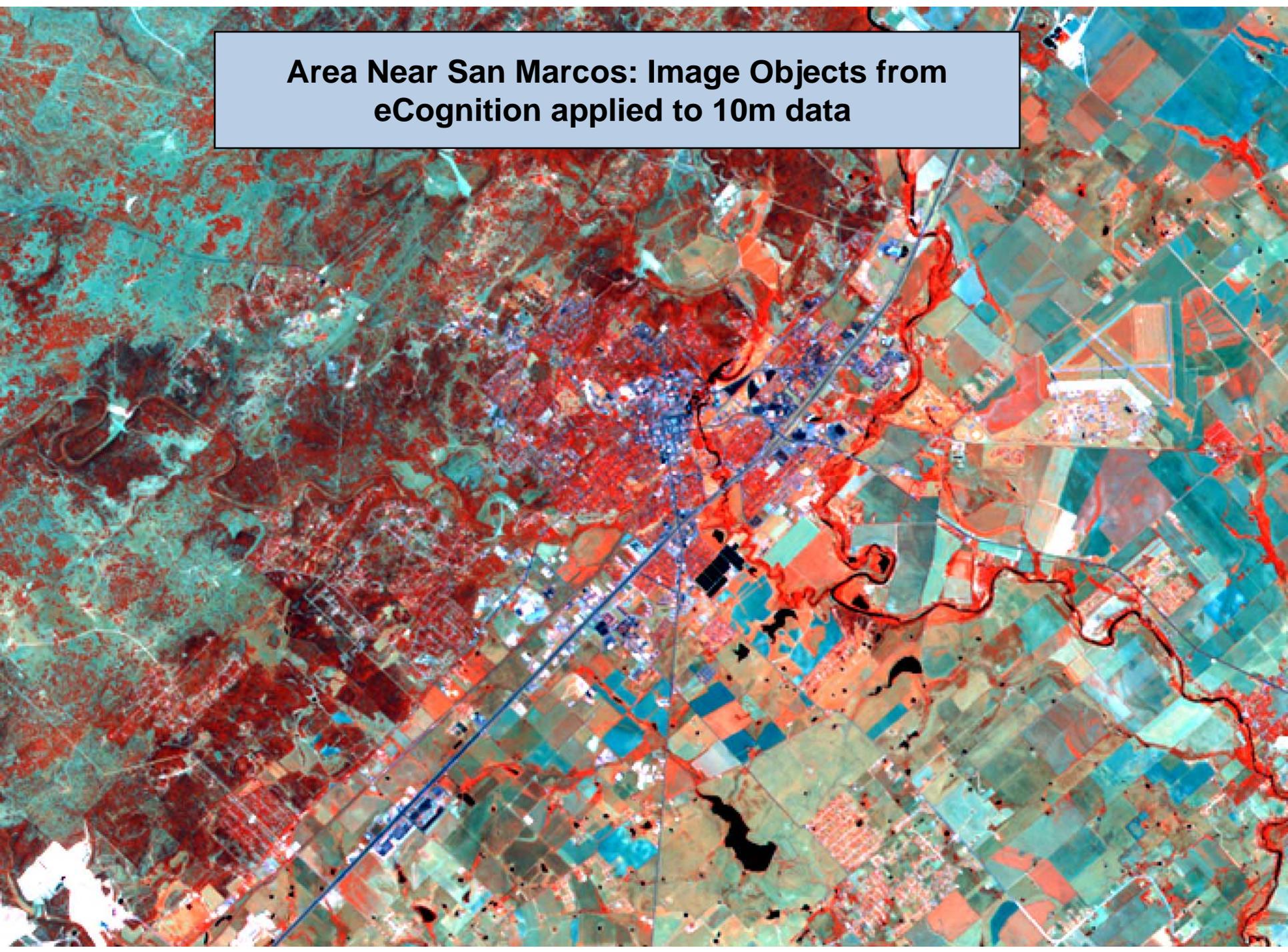


From Bailey (1996)

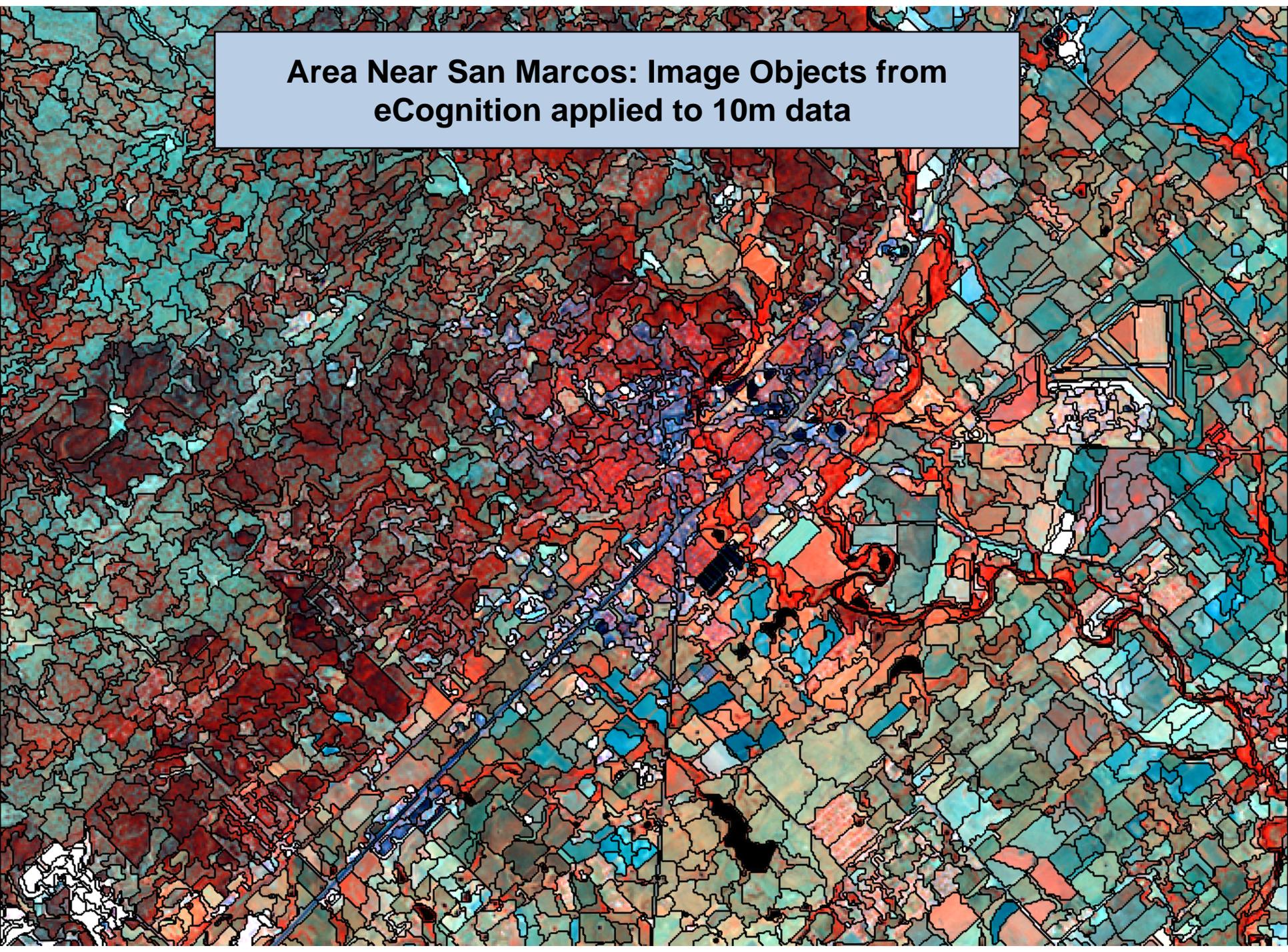


From Bailey (1996)

**Area Near San Marcos: Image Objects from
eCognition applied to 10m data**



**Area Near San Marcos: Image Objects from
eCognition applied to 10m data**

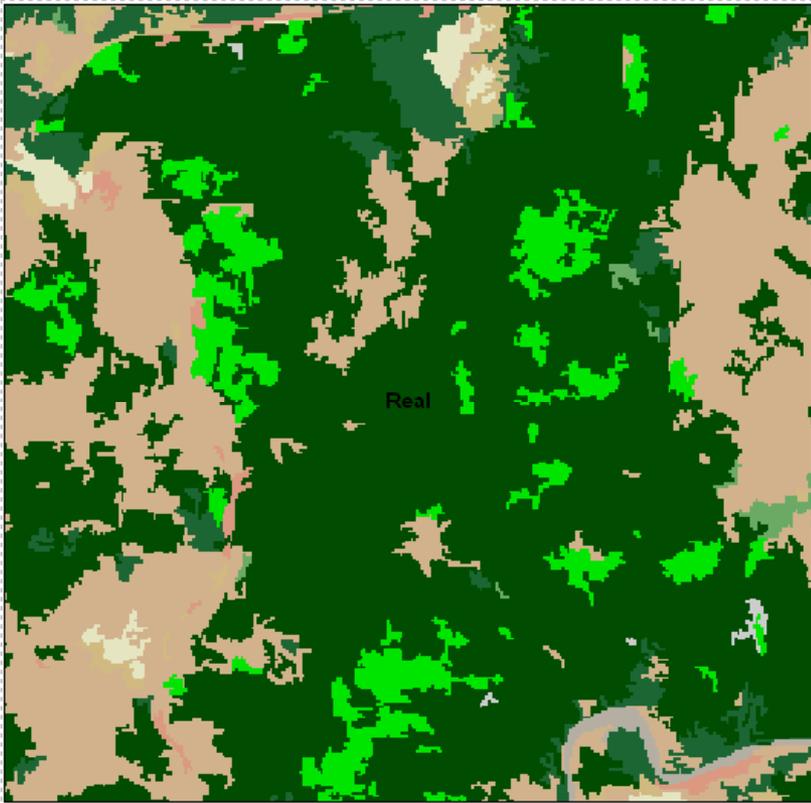


Some Lessons – Remote Sensing

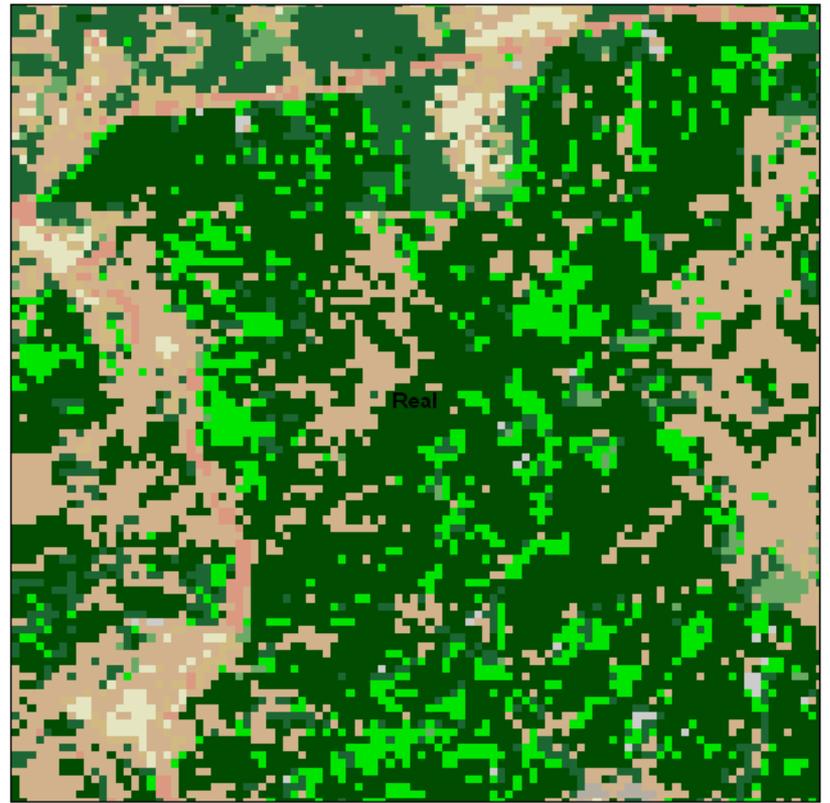
- Photo-interpretation to collect training data (need leaf on & leaf off)
- Use urban impervious & forest canopy from NLCD
- Use decision trees as classifier
- Field data collection methods and speed excellent
- Classification confusion
 - dense shrubland versus forest
 - sparse forest versus shrubland
 - grass / shrub & grass / crop separation



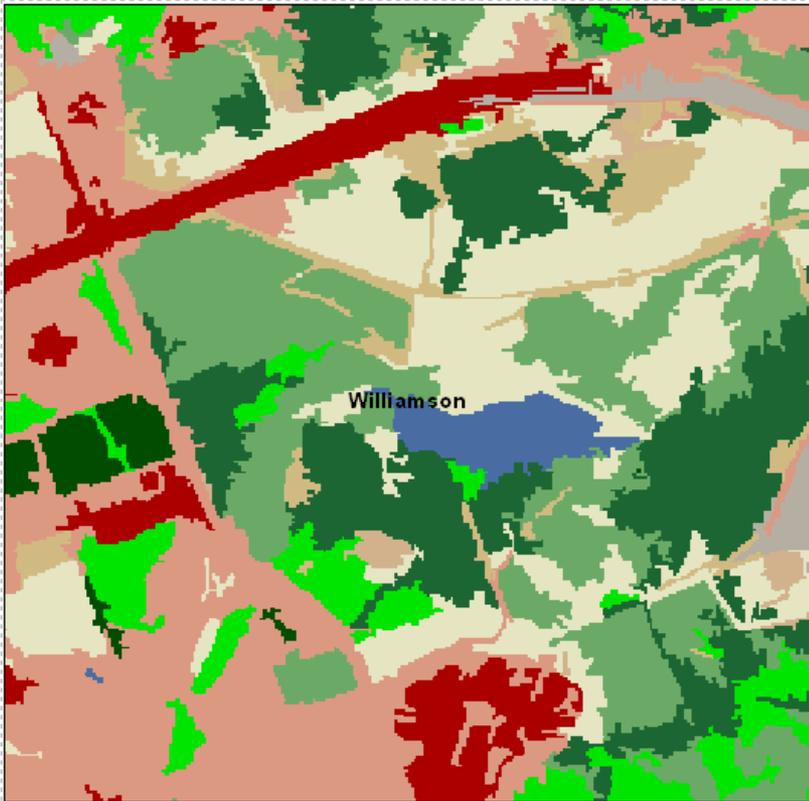
Object Based



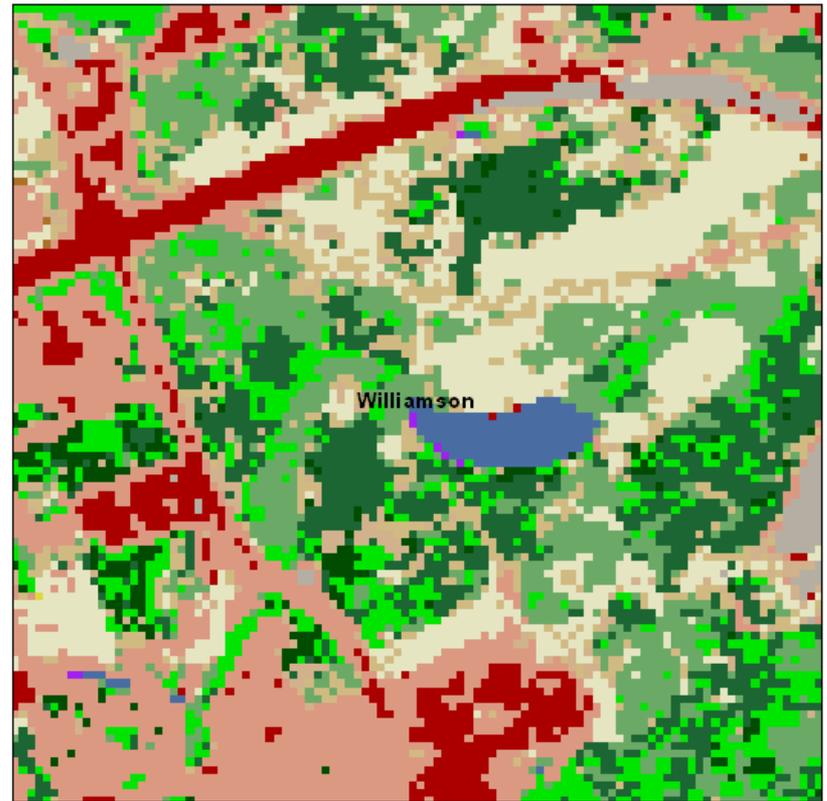
Pixel Based



Object Based



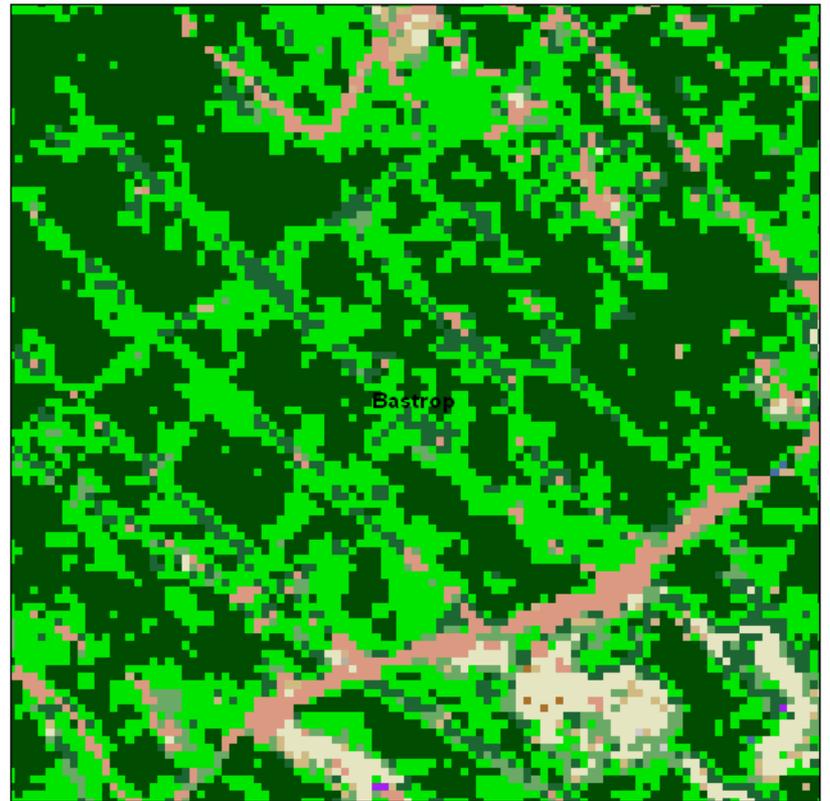
Pixel Based



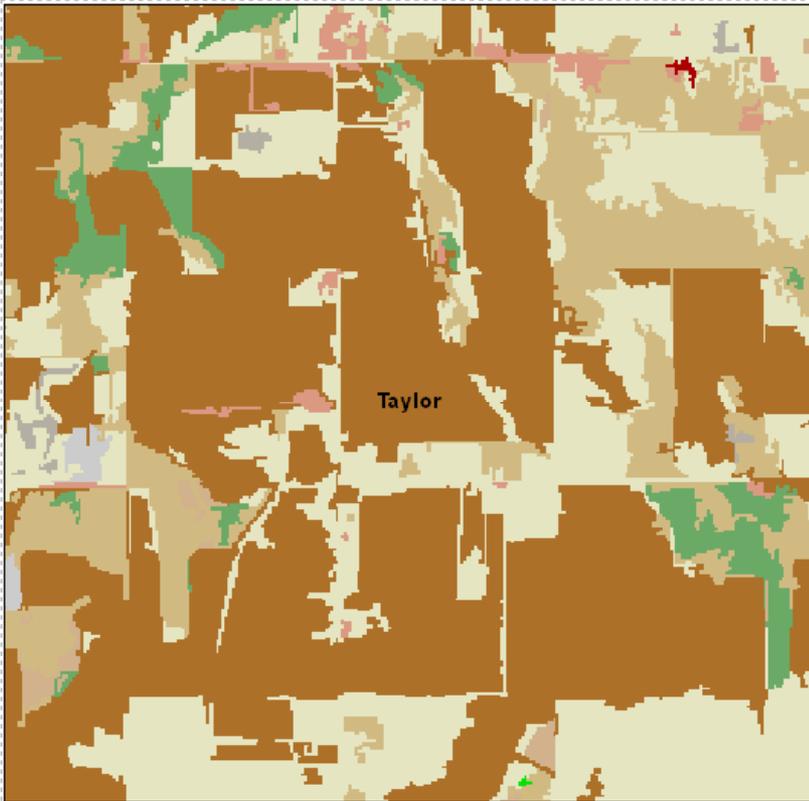
Object Based



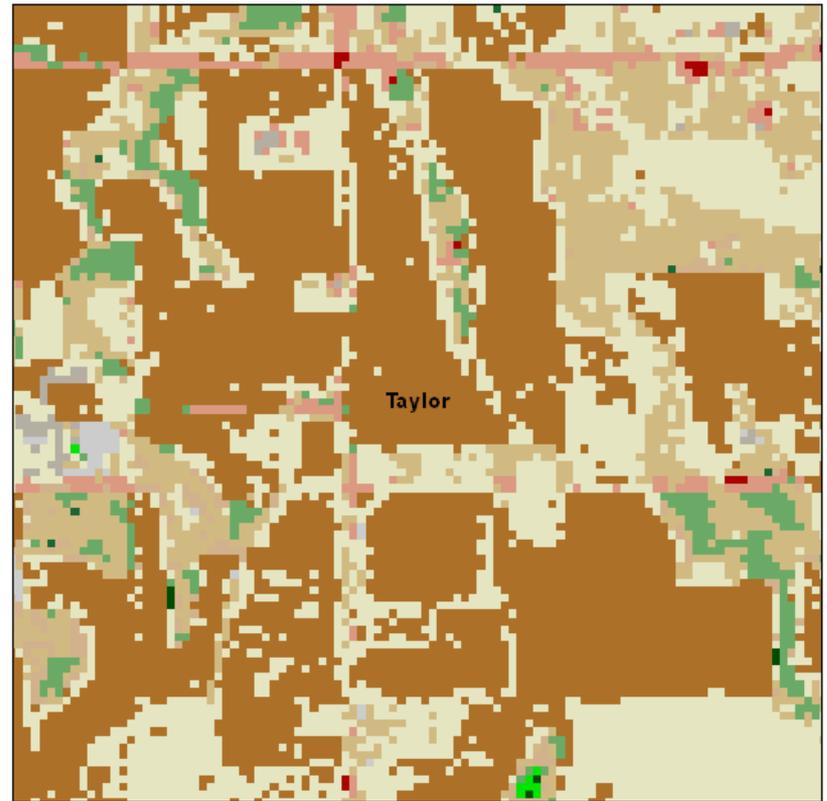
Pixel Based



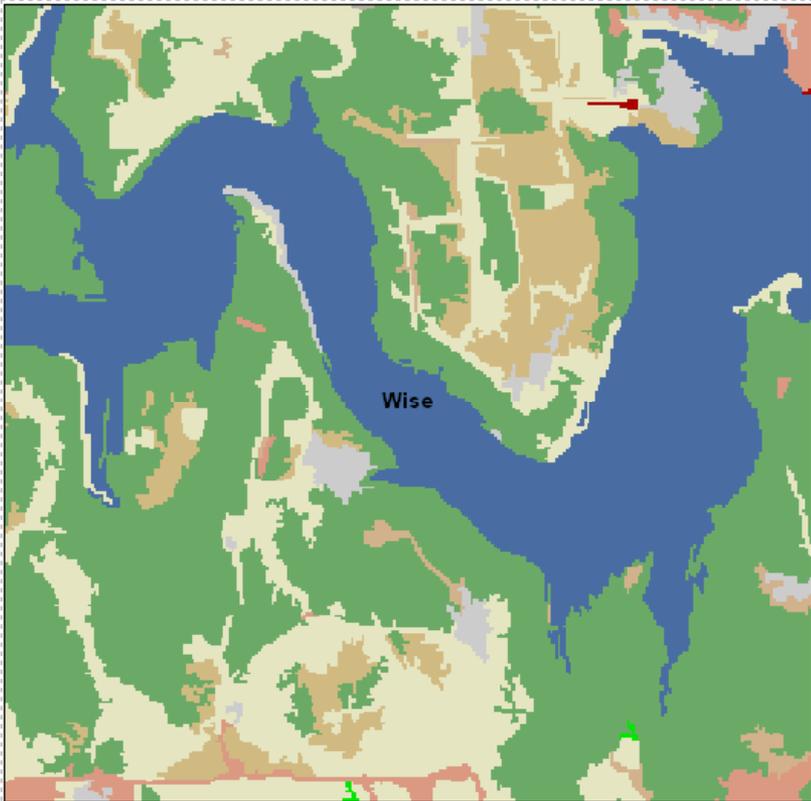
Object Based



Pixel Based



Object Based

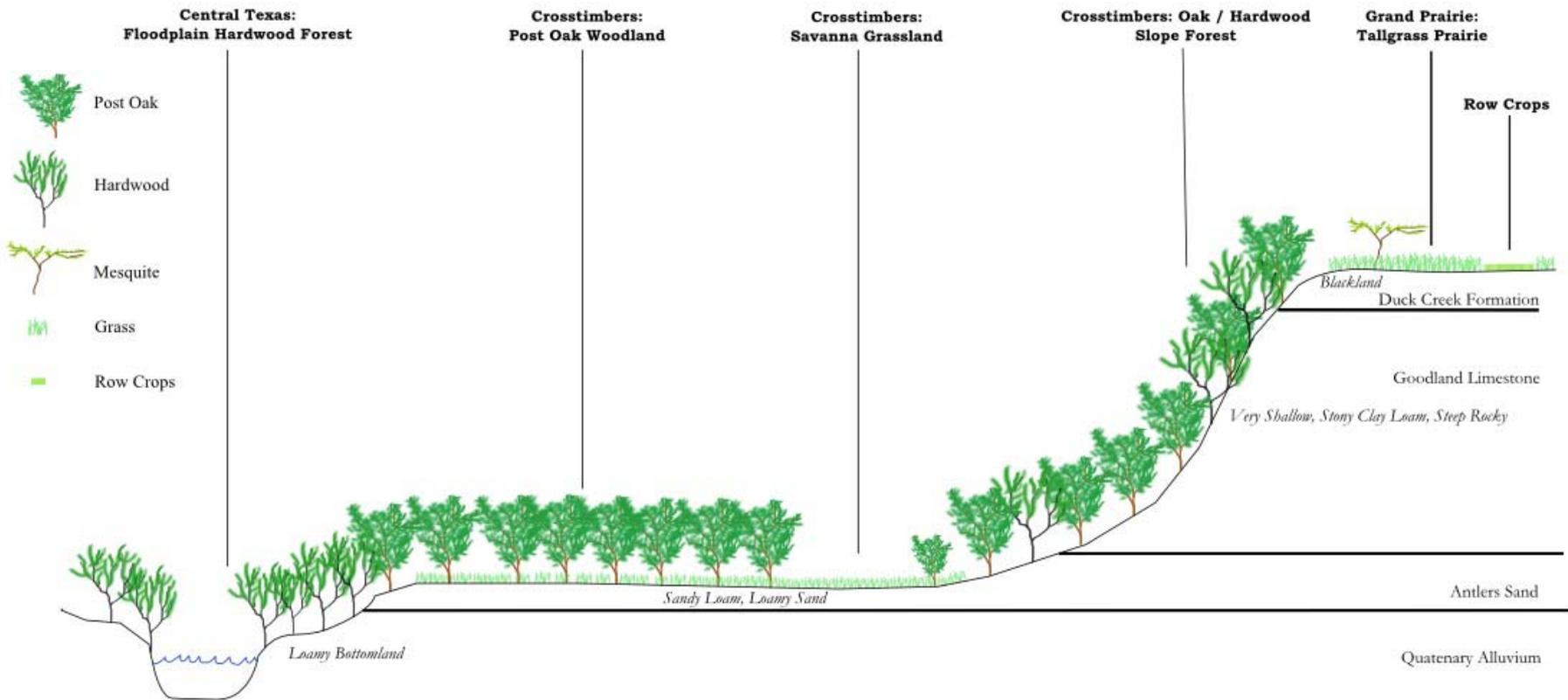


Pixel Based

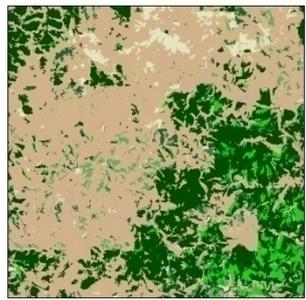


4. How are we modeling ecological subsystems?

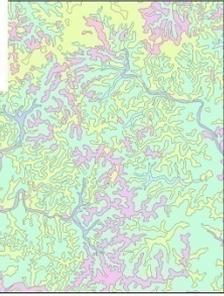
Representative Crosstimmer/Grand Prairie Mapped Vegetation



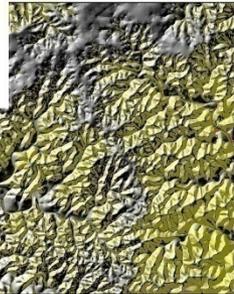
Ecosystem Modeling



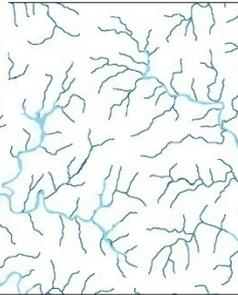
Land Cover



Digital County Soils

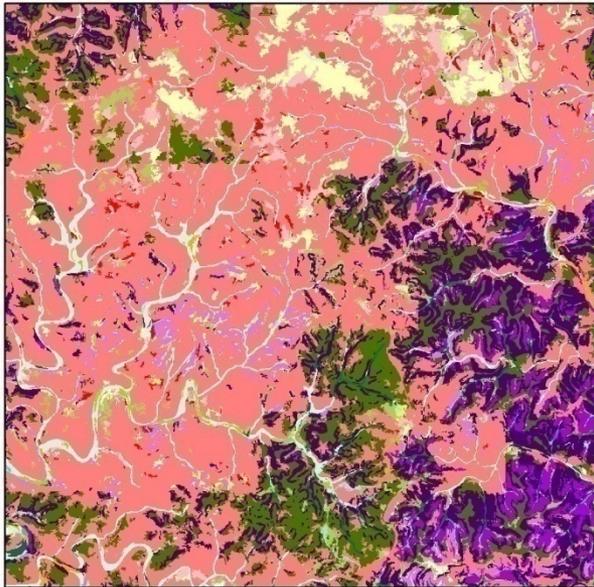


Slopes >20% in yellow
Cliffs (slopes>100%) in red



Floodplains & Riparian Zones

Final Mapped Vegetation Types



- Interpret current land cover using NRCS soils Ecological Site Types
- Add slope & cliff classes from 10 m DEM
- Model riparian classes from hi-res NHD
- Determine floodplain classes from soils

Soils to Land Cover Key

Final Keys for GIS P1 Feb2 09.xlsx - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Acrobat

Paste Clipboard Font Alignment Number Styles Cells Editing

B2 R077AY010TX

	A	B	C	D	E	F	G	H	I	J
1	Ecological Site Type Name	ecoclassid	Similar_Grp	CD_Fores	BLEG_Fores	CEG_Fores	Mix_Forest	CD_Shru	EG_Shru	Grassland
2	ROUGH BREAKS PE 25-36	R077AY010TX	1	44	34	35	44	71	2105	64
3	CLAYEY UPLAND PE 34-42	R078AY117TX	2	44	34	45	44	46	111	33
4	CLAY LOAM PE 34-42	R078AY119TX	2	44	34	45	44	46	111	33
5	CLAY SLOPES PE 34-42	R078AY120TX	2	44	34	45	44	46	111	33
6	LOAMY SAND PE 34-42	R078AY122TX	2	44	34	45	44	46	111	33
7	SHALLOW PE 34-42	R078AY125TX	2	44	34	45	44	46	111	33
8	LOAMY PE 25-36	R078BY079TX	2	44	34	45	44	46	111	33
9	LOAMY SAND PRAIRIE PE 25-36	R078BY082TX	2	44	34	45	44	46	111	33
10	SANDY LOAM PE 25-36	R078BY088TX	2	44	34	45	44	46	111	33
11	SHALLOW PE 25-36	R078BY089TX	2	44	34	45	44	46	111	33
12	CLAY LOAM PE 31-44	R078CY096TX	2	44	34	45	44	46	111	33
13	LOAMY SAND PRAIRIE PE 31-44	R078CY105TX	2	44	34	45	44	46	111	33
14	SANDY LOAM PRAIRIE PE 31-44	R078CY110TX	2	44	34	45	44	46	111	33
15	SHALLOW PE 31-44	R078CY111TX	2	44	34	45	44	46	111	33
16	CLAY FLAT PE 36-50	R080BY145TX	2	44	34	45	44	46	111	33
17	CLAY LOAM PE 36-50	R080BY146TX	2	44	34	45	44	46	111	33
18	CLAY FLAT PE 34-42	R078AY118TX	3	44	34	45	44	46	111	62
19	CLAY FLAT PE 25-36	R078BY071TX	3	44	34	45	44	46	111	62
20	CLAY FLAT PE 31-44	R078CY095TX	3	44	34	45	44	46	111	62
21	CLAY FLAT PE 31-44	R081BY324TX	3	44	34	45	44	46	111	62
22	ROCKY HILL PE 34-42	R078AY123TX	5	44	34	35	44	71	2105	33
23	GRAVELLY PE 25-36	R078BY075TX	5	44	34	35	44	71	2105	33
24	MIXEDLAND SLOPES PE 25-36	R078BY083TX	5	44	34	35	44	71	2105	33

Ready

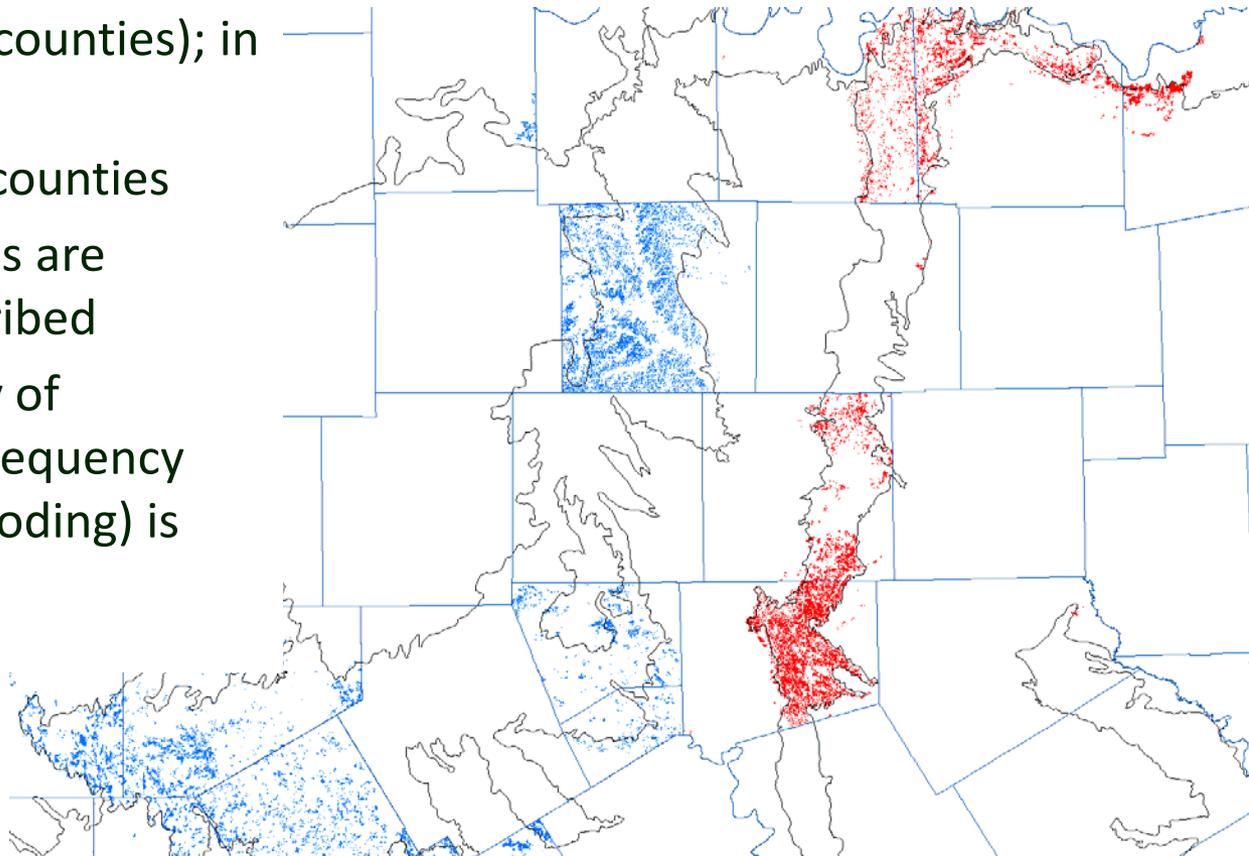
Hist Veg to Abiotic Sites Key Historic Veg to Soils Key Soils to Land Cover Key Slp >20% soils old Key

130%

Some Lessons: Modeling

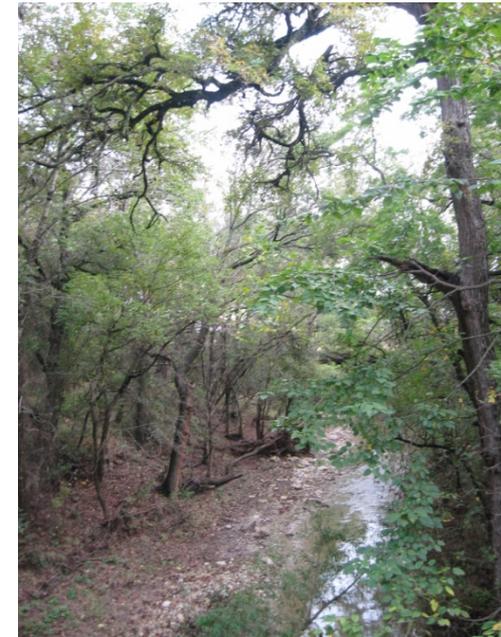
- SSURGO soils suffer from inconsistencies
 - where they are mapped (across counties and sometimes within counties); in urban areas
 - resolution among counties
 - how ecological sites are assigned and described
 - Inferring hydrology of floodplains (size, frequency and duration of flooding) is problematic

Two Tight Sandy Loam Ecological Site Types



5. What are the products?

- Higher resolution (10 meter) land cover with detailed classification (112 classes)
- Ground truth dataset
- Interpretive Booklet
 - Landscape profiles of potential and existing vegetation
 - Interpretation of the current land cover (e.g. dynamics, management)
 - Photos
 - Range maps



Questions?

Diane True, GIS Coordinator
truecd@missouri.edu

