Prospects for an Improved Current Vegetation Map for Oklahoma

August, 2011

Technical Partners Web Meeting

David Diamond and Lee Elliott, Missouri Resource Assessment Partnership, University of Missouri

Contact: diamondd@missouri.edu

Situation

- Existing products fall short in terms of thematic and spatial resolution for current vegetation type maps
- Recent advances make practical improvements possible
- A diversity of expertise is required for success

Following will outline relevant experiences in Texas and Missouri

Texas Ecological Systems Classification P

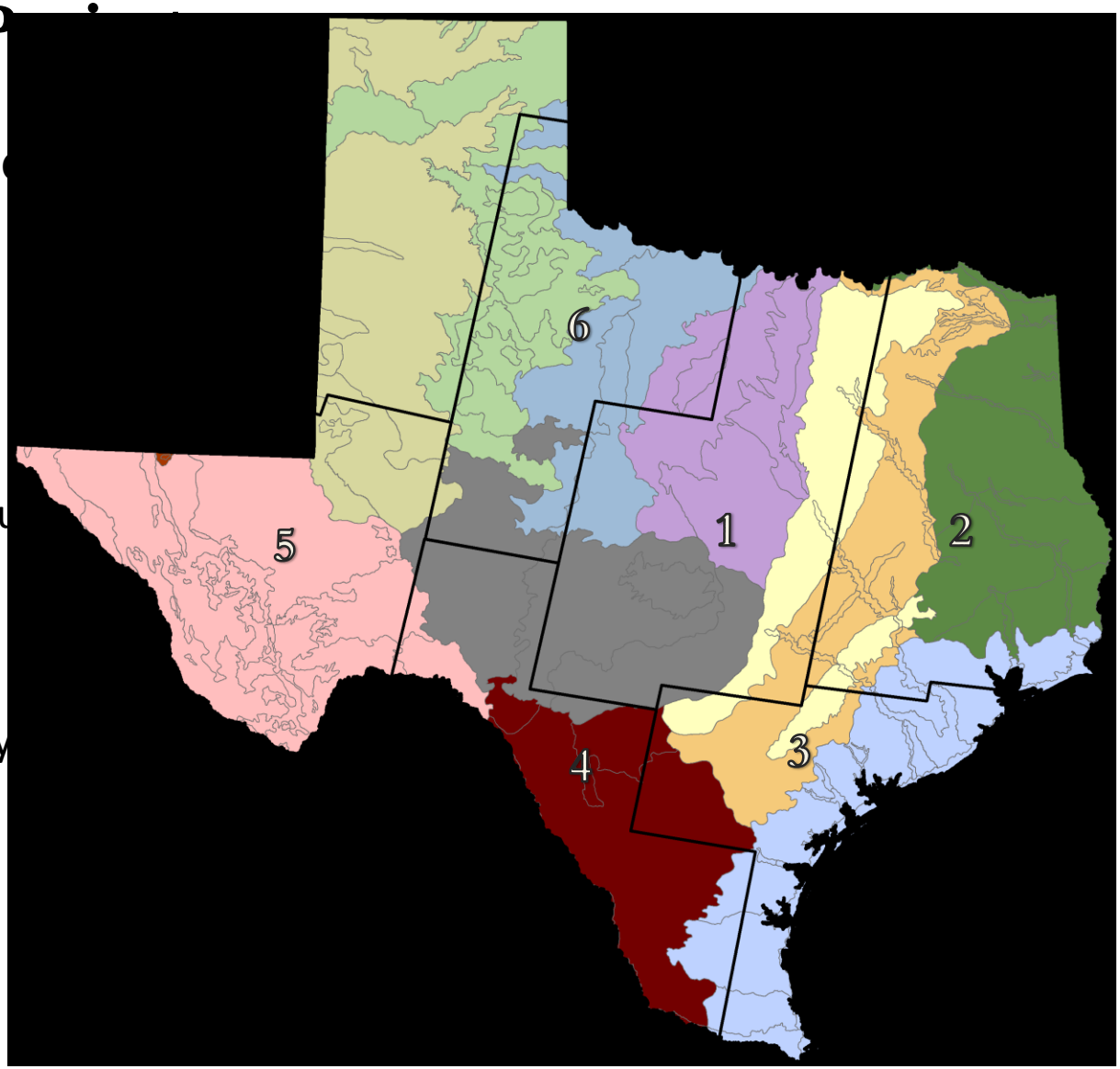
Kim Ludeke, Duane
Amie Treuer-Kuehn

Jim Scott

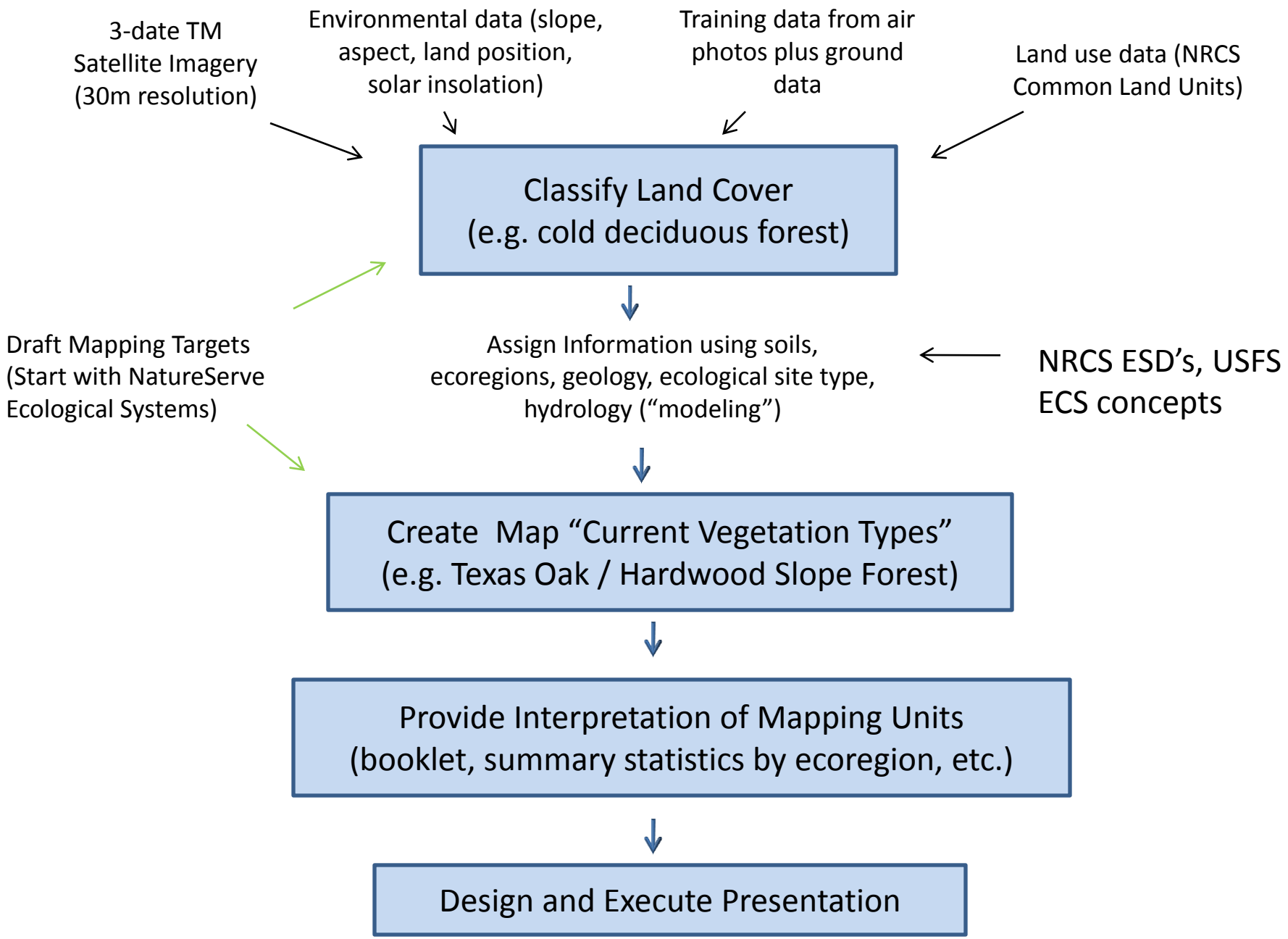
David Diamond,
Lee Elliott, Diane Tru
Clayton Blodgett,
Dyanna Pursell

Judy Teague, Milo Py

Bill Carr



http://www.tpwd.state.tx.us/landwater/land/maps/gis/tescp/index.phtml


3-date TM Satellite Imagery (30m resolution)
Environmental data (slope, aspect, land position, solar insolation)
Training data from air photos plus ground data
Land use data (NRCS Common Land Units)
Classify Land Cover (e.g. cold deciduous forest)
Draft Mapping Targets (Start with NatureServe Ecological Systems)
Assign Information using soils, ecoregions, geology, ecological site type, hydrology ("modeling")
NRCS ESD's, USFS ECS concepts
Create Map "Current Vegetation Types" (e.g. Texas Oak / Hardwood Slope Forest)
Provide Interpretation of Mapping Units (booklet, summary statistics by ecoregion, etc.)
Design and Execute Presentation

Key Tasks and Skills Needed

- Classify land cover (RS, GIS)
- Map abiotic site types (Ecology, Soils, GIS, Database Management)
- Collect ground data (Botany, Ecology, GIS)
- Model and map current vegetation types (Ecology, GIS, Database Management)
- Characterize current vegetation (Ecology, Writing)
- Prepare interpretive material (Writing, Ecology, Graphic Design)

Classify Land Cover
(15 classes – specific to Phase)

Abiotic Site Types
(Potential Vegetation)

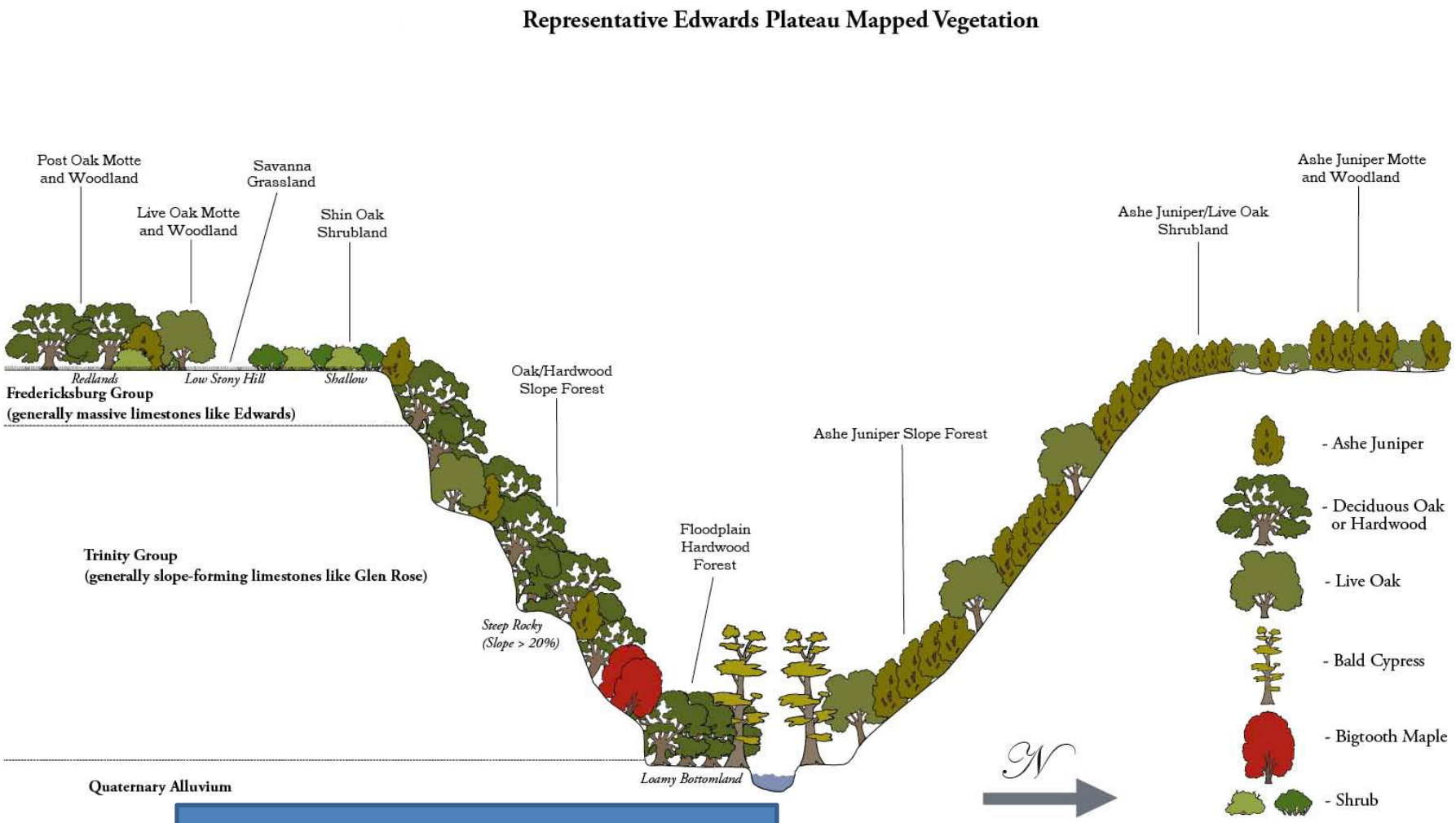
Satellite TM Data for 3 Dates (30 m)
Environmental Variables
NAIP Photos for "objects" (10 m)

SSURGO Soil Groups
Solar Insolation, %Slope
Land Position
Hydrology

Modeling: Map final current vegetation type from land cover and abiotic site type

Final Mapped Current Vegetation Types
(304 classes – Phases 1 - 4)

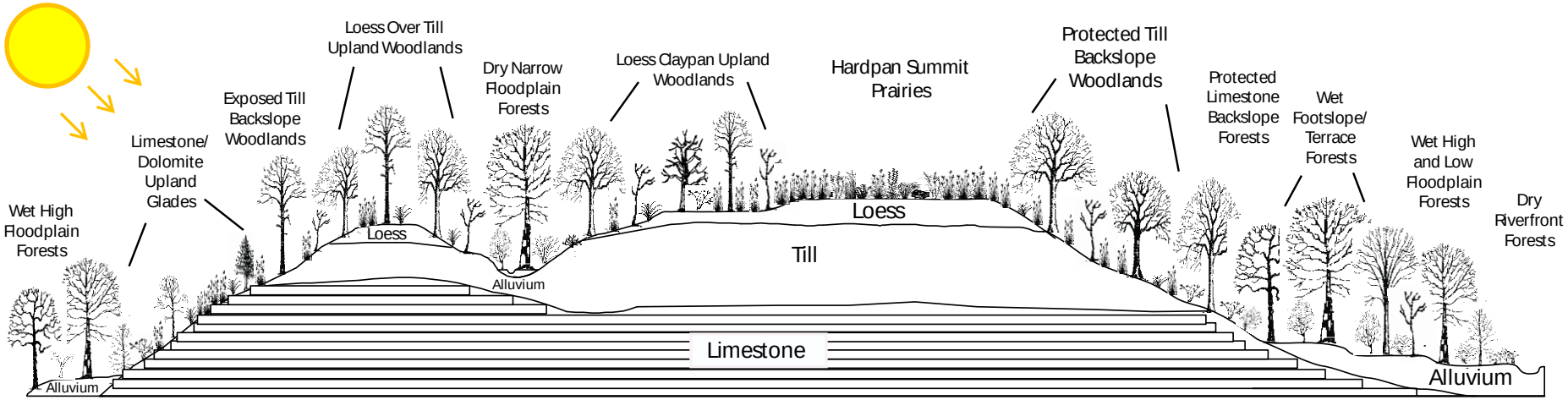
A Conceptual Edwards Plateau Landscape



Abiotic Site Types are required to model & map current vegetation

Missouri Abiotic Site Type Development Process

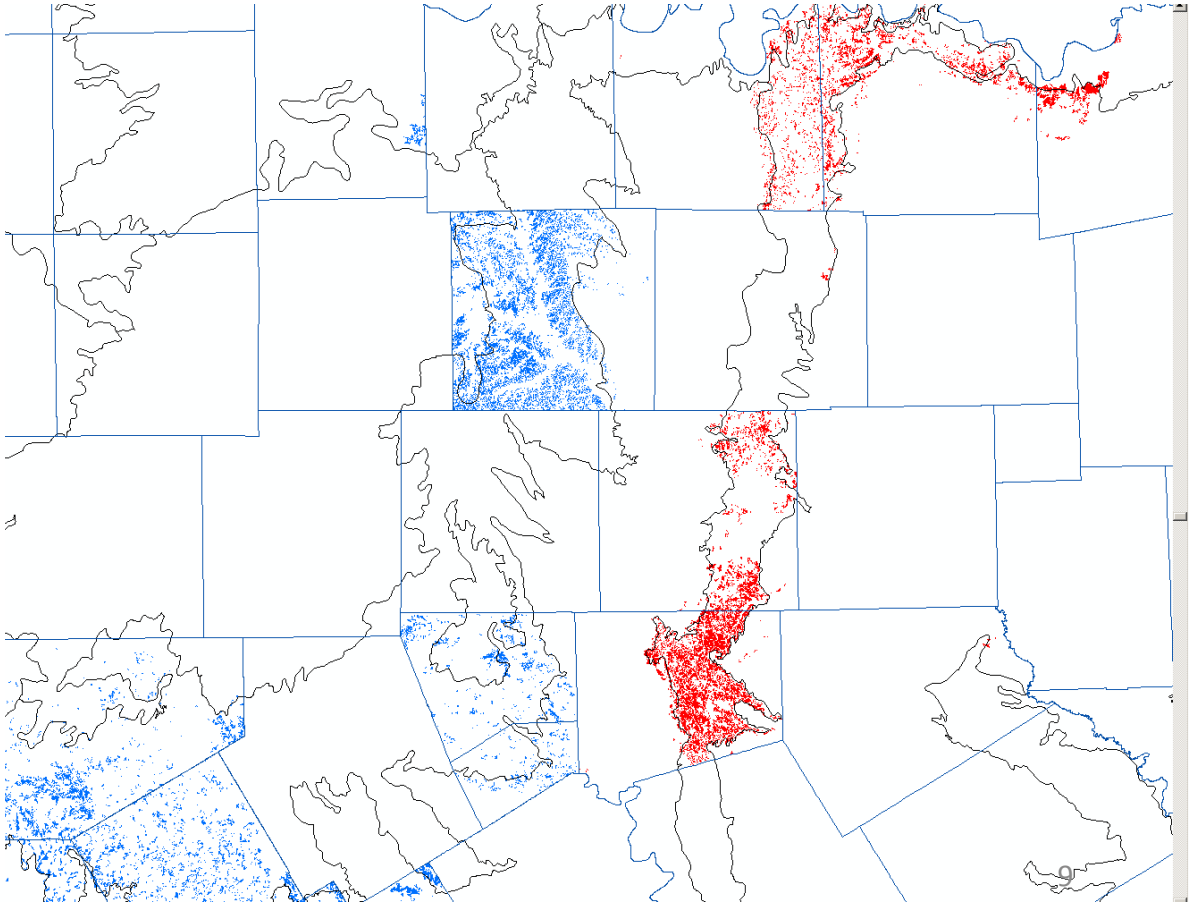
4) Potential **Natural Communities** are then tied to each land unit, resulting in **ELTs and ELT Phases**.



Problems with Soils Mapping: a limiting factor on which much work must be done

- 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)

Two Tight Sandy Loam Ecological Site Types



Classify Land Cover
(15 classes – specific to Phase)

Abiotic Site Types
(Potential Vegetation)

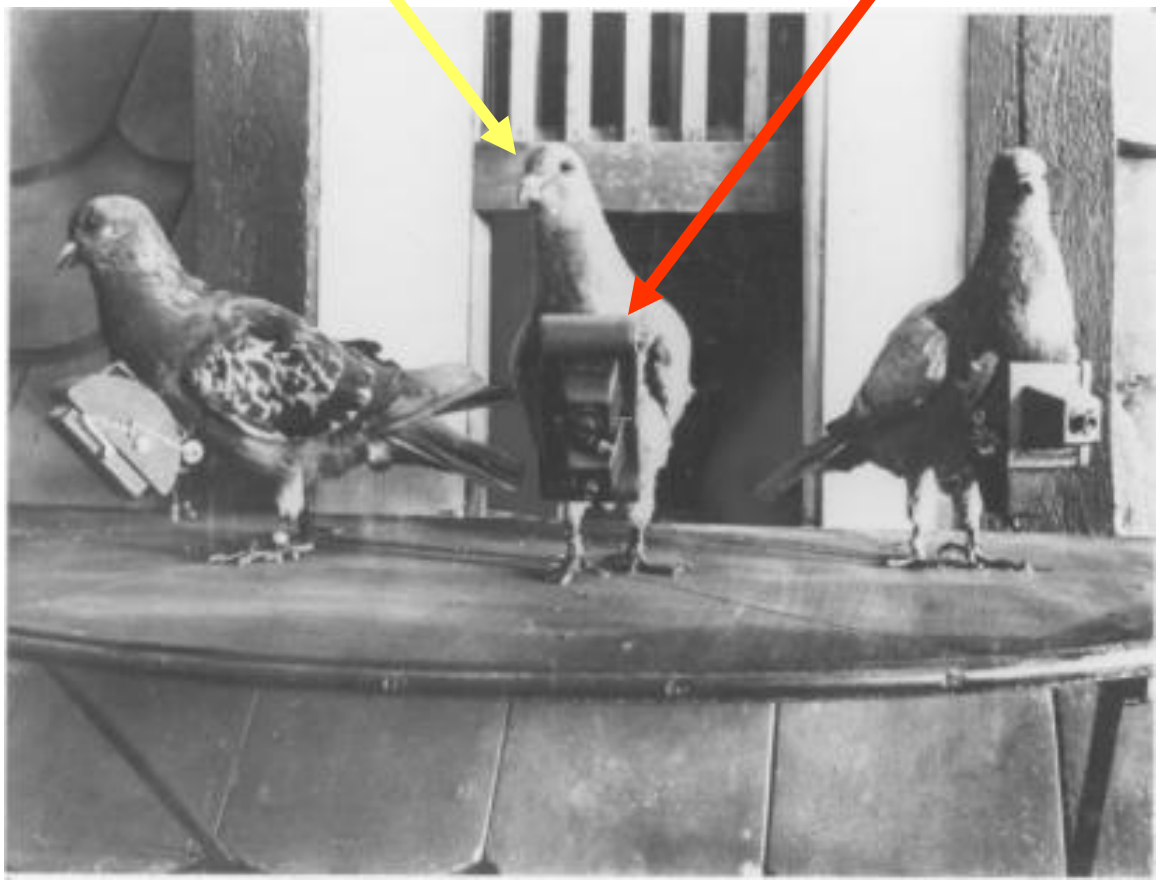
Satellite TM Data for 3 Dates (30 m)
Environmental Variables
NAIP Photos for "objects" (10 m)

SSURGO Soil Groups
Solar Insolation, %Slope
Land Position
Hydrology

Modeling: Assign final mapped current vegetation type from land cover and abiotic site type

Final Mapped Current Vegetation Types
(304 classes)

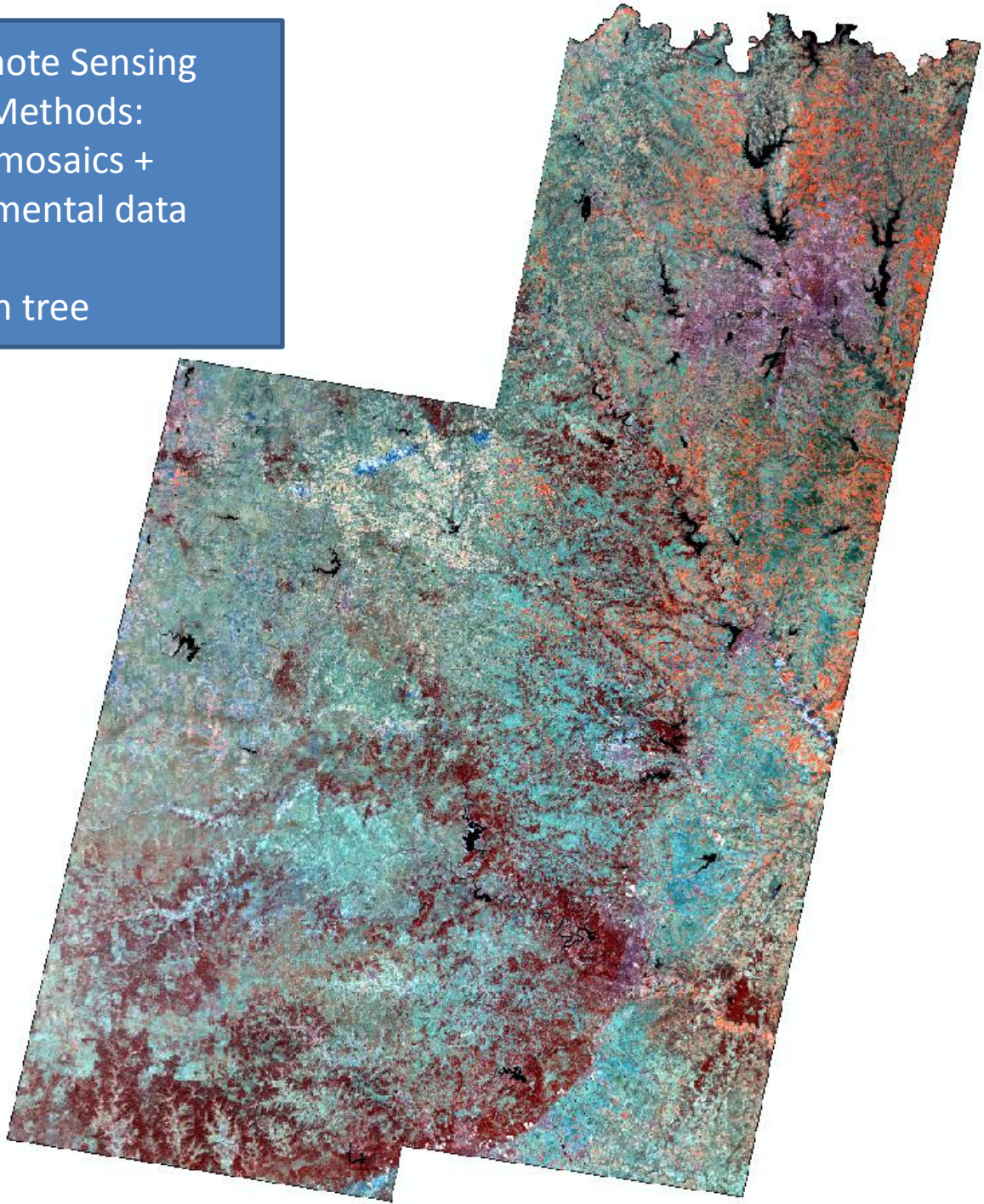
Platform and Sensor



Remote Sensing Methods:

-3-date mosaics + environmental data

-decision tree



Decision Tree Classification trained from air photos and ground-collected information

Decision Tree Classification trained from air photos and ground-collected information

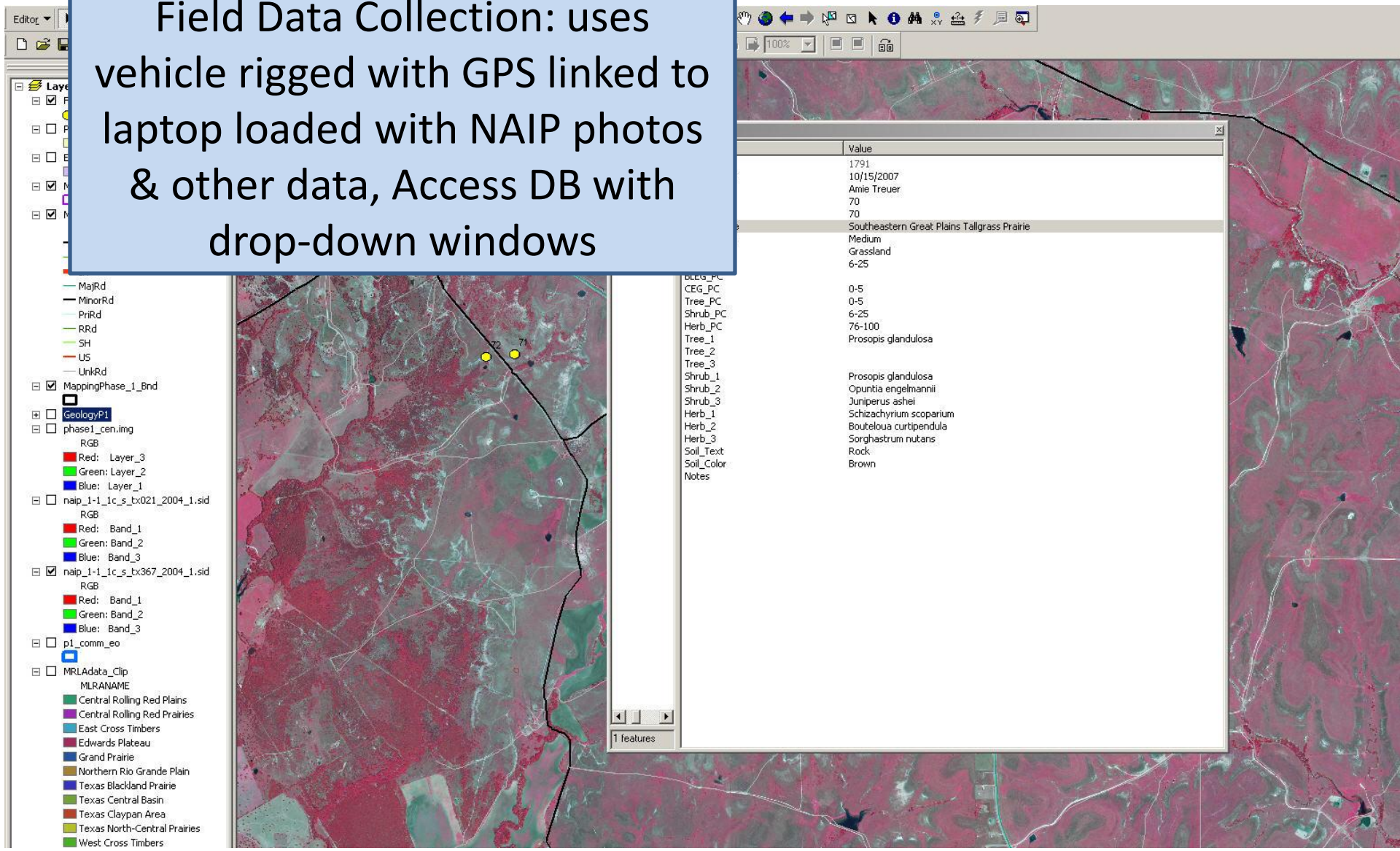
Input variables include reflectance data and environmental data

1489490.000,	7326390.000,	74,	35,	39,	58,	90,	45,	113,	56,	68,	87,	203,	129,	105,	49,	60,	77,
1703120.000,	7715550.000,	59,	24,	28,	38,	79,	40,	77,	35,	41,	64,	127,	58,	76,	33,	38,	70,
1703590.000,	7716270.000,	57,	23,	25,	41,	76,	35,	71,	31,	32,	76,	100,	40,	66,	29,	25,	83,
1704450.000,	7716890.000,	58,	24,	27,	35,	58,	29,	73,	32,	33,	55,	94,	46,	70,	31,	29,	85,
1705400.000,	7716140.000,	51,	20,	19,	34,	51,	23,	69,	30,	31,	56,	88,	39,	63,	25,	22,	69,
1706560.000,	7714890.000,	58,	25,	29,	40,	81,	40,	74,	34,	39,	62,	114,	53,	67,	29,	29,	73,
1706400.000,	7714750.000,	70,	34,	42,	60,	116,	55,	79,	39,	45,	84,	142,	59,	78,	38,	37,	102,
1707560.000,	7713590.000,	54,	24,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	134,	58,	93,	52,	73,	90,
1707320.000,	7713620.000,	62,	28,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	124,	54,	77,	36,	38,	78,
1708320.000,	7714790.000,	55,	24,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	96,	33,	81,	38,	43,	81,
1710220.000,	7715680.000,	58,	25,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	28,	60,	73,	33,	36,	72,
1711470.000,	7714320.000,	63,	29,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	48,	64,	77,	36,	39,	77,
1711630.000,	7714590.000,	63,	30,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23,	51,	71,	31,	33,	66,
1712850.000,	7713860.000,	55,	23,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33,	61,	72,	34,	38,	75,
1712750.000,	7713960.000,	56,	22,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	40,	66,	69,	29,	30,	73,
1714080.000,	7714390.000,	58,	25,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	09,	52,	65,	28,	26,	84,
1715410.000,	7715140.000,	57,	24,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	35,	56,	69,	30,	31,	55,
1716180.000,	7714120.000,	65,	30,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	35,	55,	73,	34,	35,	76,
1716000.000,	7713860.000,	64,	28,	33,	55,	102,	44,	79,	38,	44,	85,	136,	54,	73,	33,	31,	84,
1717030.000,	7714360.000,	57,	23,	27,	33,	78,	37,	76,	33,	43,	56,	130,	58,	70,	29,	31,	55,
1717400.000,	7714350.000,	63,	28,	34,	44,	94,	43,	80,	38,	47,	76,	142,	60,	74,	34,	36,	65,
1718430.000,	7714970.000,	62,	27,	34,	47,	100,	46,	78,	37,	41,	75,	137,	58,	77,	36,	42,	73,
1718310.000,	7715720.000,	52,	20,	21,	30,	60,	27,	68,	29,	32,	51,	100,	45,	63,	26,	23,	70,
1719630.000,	7714510.000,	53,	20,	21,	27,	61,	29,	69,	30,	32,	57,	106,	48,	61,	25,	18,	87,
1720990.000,	7714030.000,	69,	33,	42,	60,	109,	50,	76,	37,	42,	78,	129,	60,	73,	35,	30,	106,
1720840.000,	7713770.000,	60,	26,	30,	60,	93,	41,	76,	35,	37,	82,	128,	51,	80,	38,	44,	76,
1722190.000,	7712780.000,	55,	24,	24,	74,	73,	27,	73,	37,	38,	116,	127,	49,	85,	46,	69,	89,
1722210.000,	7712340.000,	61,	30,	37,	64,	96,	43,	87,	48,	69,	96,	175,	94,	102,	60,	89,	105,
1724120.000,	7713430.000,	59,	26,	30,	60,	91,	39,	74,	37,	39,	104,	132,	51,	69,	32,	26,	125,
1717750.000,	7743260.000,	57,	22,	26,	32,	71,	35,	72,	32,	37,	57,	118,	52,	68,	28,	31,	55,
1717930.000,	7743260.000,	60,	27,	33,	46,	95,	46,	78,	37,	41,	78,	139,	60,	79,	35,	45,	60,
1717320.000,	7744450.000,	56,	23,	26,	37,	76,	38,	73,	34,	34,	75,	112,	46,	66,	29,	24,	82,
1717200.000,	7744480.000,	58,	25,	28,	47,	88,	40,	73,	35,	36,	80,	114,	46,	68,	30,	28,	71,
1715230.000,	7744520.000,	55,	22,	24,	30,	76,	37,	71,	32,	35,	61,	118,	52,	66,	28,	28,	57,
1715120.000,	7744090.000,	53,	20,	23,	30,	71,	34,	70,	31,	32,	65,	101,	43,	64,	26,	24,	62,
1713930.000,	7745020.000,	63,	28,	34,	39,	90,	44,	81,	37,	44,	61,	134,	60,	76,	36,	40,	57,
1713810.000,	7745020.000,	64,	31,	38,	53,	91,	42,	84,	41,	51,	79,	131,	59,	84,	41,	52,	71,
1713810.000,	7746620.000,	55,	21,	23,	30,	60,	29,	70,	31,	33,	54,	94,	44,	65,	25,	23,	68,
1713930.000,	7748610.000,	58,	26,	29,	44,	84,	37,	74,	35,	37,	91,	123,	50,	76,	34,	36,	56,
1713390.000,	7748190.000,	63,	28,	33,	51,	98,	44,	77,	37,	39,	82,	129,	51,	77,	34,	40,	58,
1714130.000,	7754020.000,	55,	21,	25,	35,	68,	31,	73,	31,	36,	58,	117,	52,	67,	28,	29,	61,
1714670.000,	7755220.000,	61,	26,	32,	35,	92,	43,	80,	36,	41,	69,	131,	55,	72,	31,	34,	51,
1714210.000,	7755230.000,	63,	28,	35,	41,	102,	49,	82,	37,	46,	66,	141,	60,	76,	35,	38,	65,
1714880.000,	7756590.000,	62,	27,	34,	40,	97,	44,	80,	37,	44,	71,	138,	57,	74,	34,	39,	57,
1714610.000,	7756540.000,	62,	28,	32,	54,	95,	43,	73,	35,	37,	88,	124,	48,	76,	35,	38,	68,
1714780.000,	7757030.000,	57,	24,	26,	38,	74,	37,	76,	35,	37,	81,	113,	49,	66,	28,	27,	65,
1714760.000,	7759300.000,	61,	26,	33,	39,	94,	41,	85,	39,	53,	67,	142,	58,	72,	31,	35,	53,
1715010.000,	7759320.000,	54,	22,	19,	83,	65,	22,	72,	33,	32,	106,	112,	42,	72,	33,	31,	85,
1715590.000,	7760710.000,	62,	29,	35,	66,	107,	45,	95,	48,	60,	105,	157,	65,	81,	42,	49,	77,
1715550.000,	7762670.000,	56,	25,	27,	69,	87,	36,	66,	29,	24,	125,	91,	30,	73,	37,	37,	83,
1715080.000,	7762630.000,	59,	27,	36,	46,	102,	57,	87,	43,	59,	74,	172,	111,	71,	34,	31,	96,
1717500.000,	7763700.000,	54,	24,	24,	74,	74,	27,	77,	38,	43,	101,	139,	64,	73,	34,	36,	68,
1719680.000,	7762070.000,	55,	25,	24,	75,	75,	27,	65,	28,	24,	86,	73,	25,	80,	39,	56,	66,
1720020.000,	7755280.000,	54,	24,	23,	67,	67,	25,	74,	33,	31,	115,	96,	33,	80,	41,	57,	69,
1720060.000,	7755790.000,	60,	28,	32,	59,	100,	43,	84,	40,	44,	96,	131,	53,	76,	36,	39,	81,
1721120.000,	7755200.000,	56,	24,	28,	36,	78,	39,	90,	41,	48,	75,	122,	55,	66,	30,	30,	83,
1722610.000,	7754970.000,	60,	28,	34,	52,	99,	50,	86,	44,	54,	104,	160,	81,	79,	41,	49,	88,
1722420.000,	7754370.000,	66,	31,	38,	43,	104,	51,	72,	30,	33,	39,	101,	74,	70,	30,	28,	73,
1723400.000,	7754940.000,	55,	22,	24,	28,	62,	31,	85,	36,	42,	53,	98,	48,	70,	31,	34,	57,
1723380.000,	7755110.000,	54,	21,	24,	31,	68,	32,	82,	36,	40,	56,	97,	45,	65,	27,	26,	66,
1725580.000,	7755140.000,	57,	26,	30,	57,	88,	42,	106,	49,	54,	94,	121,	51,	72,	32,	37,	48,
1730090.000,	7755140.000,	63,	29,	35,	46,	101,	47,	87,	39,	46,	74,	136,	57,	75,	36,	38,	66,
1758840.000,	7751680.000,	54,	22,	22,	31,	64,	31,	71,	31,	33,	59,	100,	46,	62,	27,	23,	74,
1758460.000,	7753100.000,	58,	23,	25,	38,	72,	35,	69,	32,	32,	69,	101,	44,	64,	29,	26,	77,
1758240.000,	7753490.000,	52,	21,	23,	29,	69,	35,	69,	30,	33,	57,	113,	52,	60,	25,	21,	73,
1759540.000,	7753860.000,	56,	29,	43,	52,	107,	64,	66,	30,	28,	95,	86,	34,	72,	36,	41,	89,
1759710.000,	7753540.000,	63,	30,	35,	66,	109,	49,	75,	37,	41,	107,	132,	52,	76,	37,	41,	86,
1760340.000,	7753490.000,	53,	22,	25,	39,	79,	37,	70,	30,	32,	62,	107,	46,	59,	24,	20,	80,
1760330.000,	7753610.000,	55,	22,	24,	34,	72,	33,	67,	29,	30,	53,	96,	42,	60,	25,	20,	82,
1757160.000,	7754020.000,	60,	26,	29,	44,	89,	41,	72,	33,	36,	66,	113,	46,	77,	35,	40,	60,
1757080.000,	7753630.000,	58,	25,	28,	37,	79,	40,	74,	33,	37,	67,	124,	54,	76,	35,	39,	63,
1756710.000,	7752250.000,	65,	31,	41,	55,	120,	61,	76,	38,	44,	95,	146,	59,	78,	38,	42,	81,
1756480.000,	7752230.000,	61,	27,	35,	47,	105,	54,	79,	39,	47,	83,	151,	68,	79,	38,	47,	70,
1756190.000,	7750430.000,	64,	30,	37,	44,	106,	49,	81,	39,	46,	86,	143,	57,	74,	34,	37,	59,
1755900.000,	7750440.000,	53,	22,	21,	70,	69,	25,	64,	27,	25,	100,	77,	30,	77,	37,	43,	78,
1756410.000,	7747050.000,	54,	22,	27,	37,	78,	37,	71,	31,	35,	59,	116,	51,	64,	27,	26,	73,
1755080.000,	7746060.000,	62,	28,	35,	39,	101,	48,	81,	38,	46,	68,	139,	61,	75,	34,	36,	56,
1755010.000,	7746350.000,	60,	25,	31,	36,	86,	41,	76,	35,	39,	71,	126,	51,	70,	30,	32,	49,
1754690.000,	7747650.000,	57,	25,	28,	39,	76,	37,	78,	36,	42,	68,	131,	62,	83,	38,	45,	60,
1754950.000,	7747670.000,	58,	25,	31,	36,	91,	43,	80,	37,	45,	66,	141,	64,	69,	30,	33,	60,
1753790.000,	7748390.000,	57,	22,	25,	32,	66,	31,	73,	34,	37,	64,	119,	50,	71,	31,	34,	48,
1753640.000,	7748160.000,	59,	26,	30,	37,	84,	41,	76,	36,	42,	68,	130,	55,	76,	34,	38,	56,
1751700.000,	7748110.000,	55,	24,	29,	37,	86,	49,	62,	27,	25,	87,	77,	30,	78,	38,	45,	66,
1751700.000,	7748430.000,	63,	28,	36,	51,	104,	48,	76,	36,	40,	92,	134,	54,	74,	32,	35,	52,

Decision Tree Classifier and ‘boosting’


```
id="See5/C5.0 2.03 2008-09-03"
entries="20"
type="1" class="15" freq="163,489,1160,1051,676,649,12,1939,387,130,125,378,3,433,52" att="band27" forks="4"
type="0" class="15"
type="0" class="15"
type="2" class="15" freq="163,489,1141,1000,14,64
type="0" class="15"
type="2" class="15" freq="157,487,1133,996,14,639
type="0" class="15"
type="2" class="15" freq="142,111,157,762,13,342,
type="0" class="15"
type="2" class="21" freq="1,0,0,0,0,0,0,0,0,129,0,0,0,0,3" att="band11" forks="3" cut="32"
type="0" class="21"
type="0" class="21" freq="1,0,0,0,0,0,0,0,0,127,0,0,0,0,0"
type="2" class="33" freq="0,0,0,0,0,0,0,0,0,2,0,0,0,0,3" att="band23" forks="3" cut="84"
type="0" class="33"
type="0" class="33" freq="0,0,0,0,0,0,0,0,0,0,0,0,0,0,3"
type="0" class="21" freq="0,0,0,0,0,0,0,0,0,2,0,0,0,0,0"
type="2" class="15" freq="141,111,157,762,13,342,9,1148,10,0,9,48,2,26,6" att="band09" forks="3" cut="75"
type="0" class="15"
type="2" class="15" freq="5,111,157,762,13,342,9,1148,10,0,4,47,2,26,6" att="band02" forks="3" cut="35"
type="0" class="15"
type="2" class="15" freq="1,111,157,761,13,326,0,1139,10,0,2,33,0,26,6" att="band18" forks="3" cut="57"
type="0" class="15"
type="2" class="7" freq="0,20,93,262,0,20,0,228,3,0,1,15,0,13,6" att="band17" forks="3" cut="99"
type="0" class="7"
type="2" class="5" freq="0,2,27,5,0,1,0,7,0,0,1,3,0,0,6" att="band06" forks="3" cut="27"
type="0" class="5"
type="2" class="33" freq="0,0,0,0,0,1,0,0,0,0,1,0,0,0,5" att="band02" forks="3" cut="20"
type="0" class="33"
type="0" class="33" freq="0,0,0,0,0,0,0,0,0,0,0,0,0,0,5"
type="0" class="11" freq="0,0,0,0,0,1,0,0,0,0,1,0,0,0,0"
type="2" class="5" freq="0,2,27,5,0,0,0,7,0,0,0,3,0,0,1" att="band04" forks="3" cut="48"
type="0" class="5"
type="2" class="5" freq="0,0,27,5,0,0,0,2,0,0,0,2,0,0,1" att="band15" forks="3" cut="40"
type="0" class="5"
type="2" class="5" freq="0,0,27,5,0,0,0,1,0,0,0,0,0,0,1" att="band06" forks="3" cut="42"
type="0" class="5"
type="2" class="5" freq="0,0,27,3,0,0,0,1,0,0,0,0,0,0,1" att="band14" forks="3" cut="34"
type="0" class="5"
type="0" class="5" freq="0,0,27,2,0,0,0,0,0,0,0,0,0,0,1"
type="0" class="7" freq="0,0,0,1,0,0,0,1,0,0,0,0,0,0,0"
type="0" class="7" freq="0,0,0,2,0,0,0,0,0,0,0,0,0,0,0"
type="0" class="25" freq="0,0,0,0,0,0,0,1,0,0,0,2,0,0,0"
type="2" class="15" freq="0,2,0,0,0,0,0,5,0,0,0,1,0,0,0" att="band23" forks="3" cut="84"
type="0" class="15"
type="0" class="15" freq="0,0,0,0,0,0,0,5,0,0,0,1,0,0,0"
type="0" class="3" freq="0,2,0,0,0,0,0,0,0,0,0,0,0,0,0"
type="2" class="7" freq="0,18,66,257,0,19,0,221,3,0,0,12,0,13,0" att="band05" forks="3" cut="90"
type="0" class="7"
type="2" class="7" freq="0,17,52,200,0,17,0,85,3,0,0,12,0,13,0" att="band02" forks="3" cut="28"
type="0" class="7"
type="2" class="7" freq="0,17,52,199,0,17,0,85,3,0,0,3,0,13,0" att="band10" forks="3" cut="60"
type="0" class="7"
type="2" class="15" freq="0,0,0,5,0,4,0,19,1,0,0,0,0,0,0" att="band16" forks="3" cut="56"
type="0" class="15"
type="0" class="15" freq="0,0,0,0,0,1,0,17,1,0,0,0,0,0,0"
type="2" class="7" freq="0,0,0,5,0,3,0,2,0,0,0,0,0,0,0" att="band10" forks="3" cut="58"
type="0" class="7"
type="2" class="11" freq="0,0,0,2,0,3,0,0,0,0,0,0,0,0,0" att="band01" forks="3" cut="55"
type="0" class="11"
type="0" class="11" freq="0,0,0,0,0,2,0,0,0,0,0,0,0,0,0"
type="0" class="7" freq="0,0,0,2,0,1,0,0,0,0,0,0,0,0,0"
type="2" class="7" freq="0,0,0,3,0,0,0,2,0,0,0,0,0,0,0" att="band13" forks="3" cut="78"
type="0" class="7"
type="0" class="7" freq="0,0,0,3,0,0,0,0,0,0,0,0,0,0,0"
```

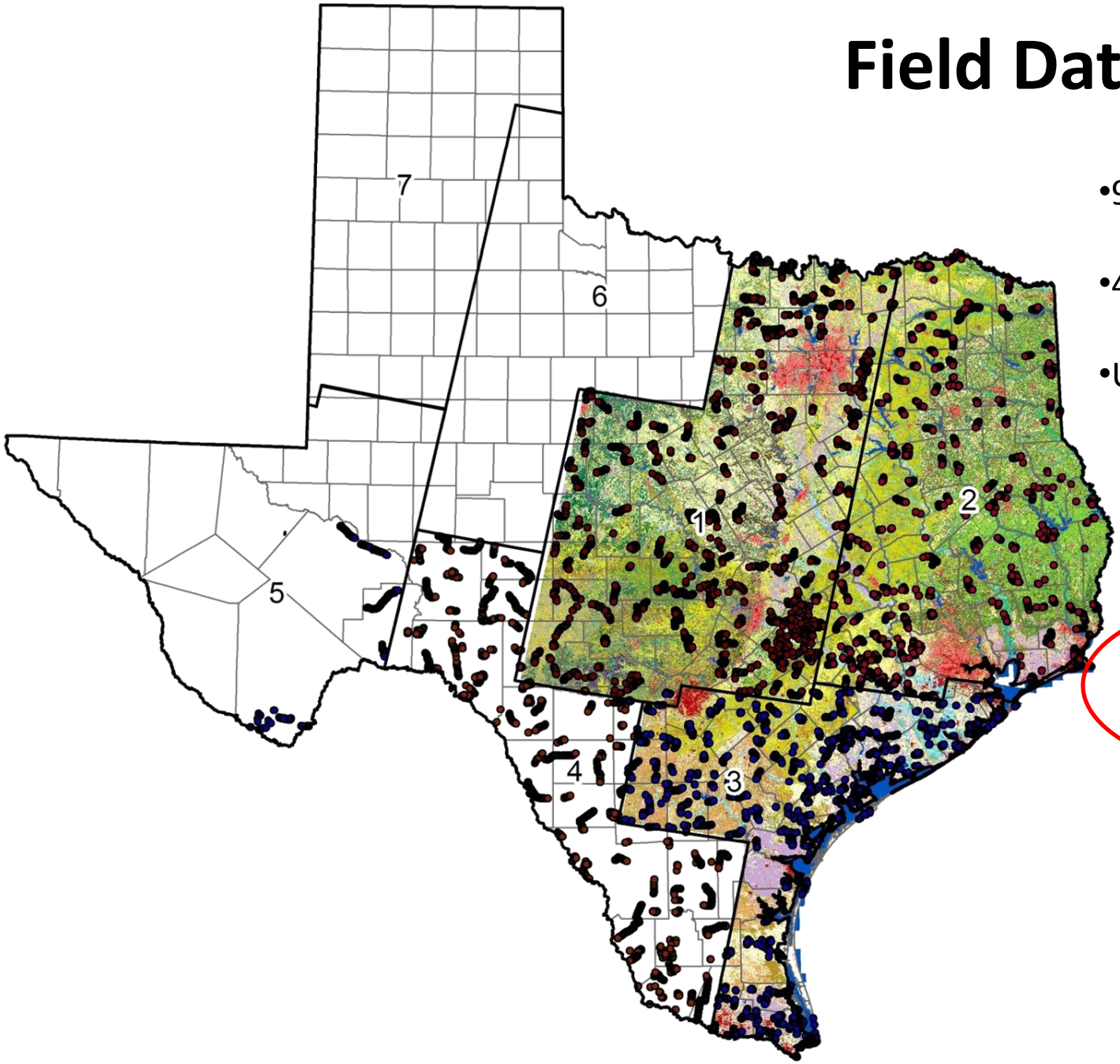
Field Data Collection: uses vehicle rigged with GPS linked to laptop loaded with NAIP photos & other data, Access DB with drop-down windows



Quantitative Field Data Collection

- top 3 dominant species in tree, shrub, and herbaceous strata
- total percent cover by cover class by strata
- land cover, ecological system/subsystem
- reference photo

Field Data Collection



- 9000 and counting
- 400 + Field Days
- Used to:
  - Map land-cover
  - Check accuracy
  - Describe mapped current vegetation types

Improving spatial resolution by use of image objects

Object generation (from eCognition here)
works remarkably well on a variety of data

Pixel-based vs object-based land cover

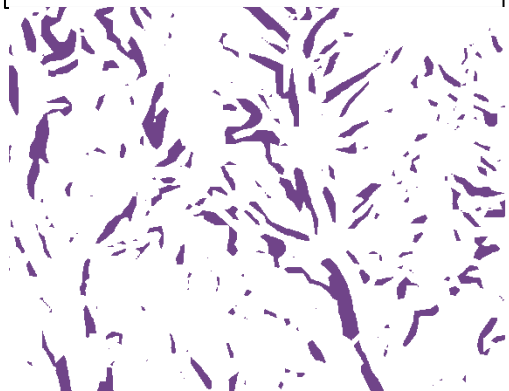
Pixel-based vs object-based land cover

Current Vegetation Type Modeling: Attribution of Image Objects & Application of Rules

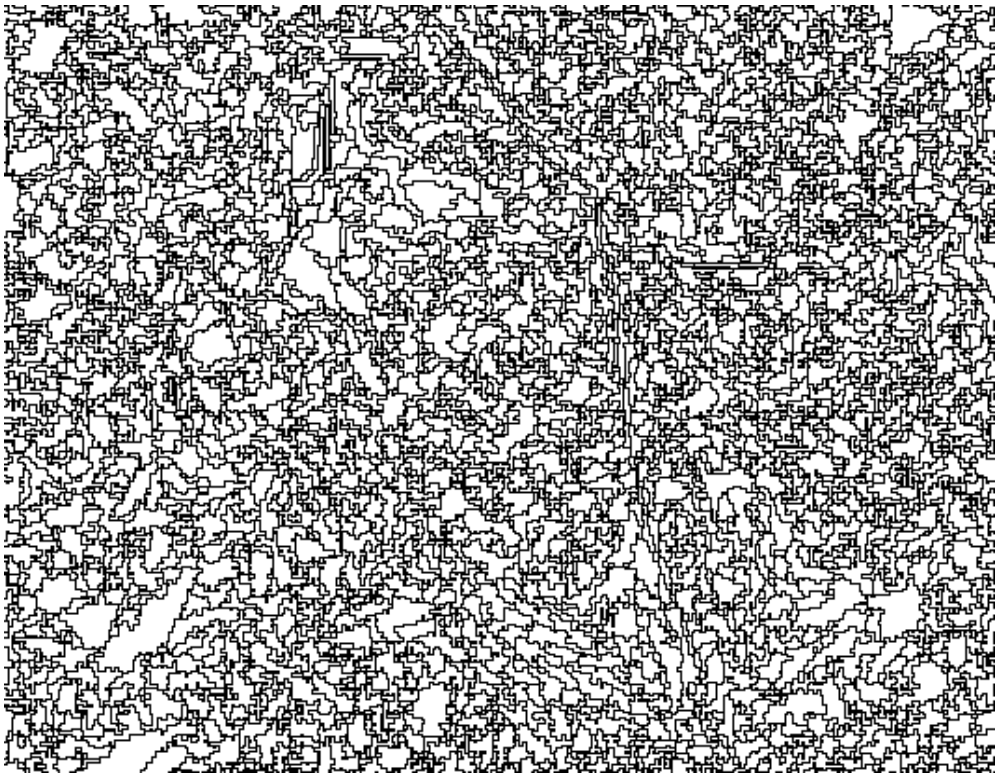
Land Cover

Soils

Extreme Land Positions



Steep Slopes



Allows “extension” of land cover classification and polygons can be re-coded, unlike pixels

Modeling Current Vegetation Type Using Abiotic Site Types and Landcover

	A	B	D	E	F	G	H	I	J
			LANDCOVER						
	Ecological Site Type Name	Ecoclassid	Deciduous Forest	Broadleaved Evergreen Forest	Conifer Forest	Mixed Forest	Deciduous Shrub	Evergreen Shrub	Grassland
	LOAMY SAND PE 31-44	R083AY396TX	2	109	45	4	46	111	115
	TIGHT SANDY LOAM PE 19-31	R083AY411TX	2	109	45	4	46	111	115
	TIGHT SANDY LOAM PE 31-44	R083AY412TX	2	109	45	4	46	111	115
	CLAYPAN PRAIRIE PE 44-64	R086AY200TX	2	109	45	45	46	111	115
	GRAVELLY LOAM PE 44-64	R086AY202TX		109	45	45	46	111	115
	CLAYPAN PRAIRIE PE 64+	R086AY556TX		109	45	45	46	111	115
	CLAYPAN SAVANNAH 44-64	R086AY582TX		109	45	4	46	111	115
0	SHALLOW CLAY PE 34-42	R078AY126TX		34	35	44	20	18	64
1	VERY SHALLOW PE 34-42	R078AY128TX		34	35	44	20	18	64
2	VERY SHALLOW PE 25-36	R078BY091TX	44	34	35	44	20	18	64
3	SHALLOW CLAY PE 31-44	R078CY112TX	44	34	35	44	20	18	64
4	VERY SHALLOW PE 31-44	R078CY113TX	44	34	35	44	20	18	64
5	VERY SHALLOW CLAY PE 31-44	R078CY114TX	44	34	35	44	20	18	64

	B	C	D	E
	Ecological System	Mapped Subsystem	Common Name	Code
	East-Central Texas Plains Post Oak Savanna and Woodland	East-Central Texas Plains Post Oak Motte and Woodland	Post Oak Savanna: Post Oak Motte and Woodland	2
	East-Central Texas Plains Post Oak Savanna and Woodland	East-Central Texas Plains Post Oak-Eastern Redcedar Motte and Woodland	Post Oak Savanna: Post Oak / Redcedar Motte and Woodland	3
	East-Central Texas Plains Post Oak Savanna and Woodland	East-Central Texas Plains Post Oak-Yaupon Motte and Woodland	Post Oak Savanna: Post Oak / Yaupon Motte and Wo	4
	East-Central Texas Plains Post Oak Savanna and Woodland	East-Central Texas Plains Deciduous Slope Woodland and Forest	Post Oak Savanna: Oak / Hardw	76
	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	109
	East-Central Texas Plains Post Oak Savanna and Woodland	East-Central Texas Plains Oak-Eastern Redcedar Slope Woodland and Forest	Post Oak Savanna: Oak / Redcedar Slope Forest	125
	East-Central Texas Plains Post Oak Savanna and Woodland	East-Central Texas Plains Eastern Redcedar Slope Woodland and Forest	Post Oak Savanna: Redcedar Slope Forest	126
	East-Central Texas Plains Post Oak Savanna and Woodland	East-Ce	na: Savanna Grassland	115
0	East-Central Texas Plains Xeric Sandyland	East-Ce	na: Sandyland Woodland and Shrubland	13
1	East-Central Texas Plains Xeric Sandyland	East-Ce	na: Sandyland Grassland	135
2	Crosstimbers Oak Forest and Woodland	Crossti	ost Oak Woodland	7
3	Crosstimbers Oak Forest and Woodland	Crosstimbers Post Oak-Juniper Forest and Woodland	Crosstimbers: Post Oak / Juniper Woodland	8
4	Crosstimbers Oak Forest and Woodland	Crosstimbers Live Oak Forest and Woodland	Crosstimbers: Live Oak Forest and Woodland	121

Database management protocols required to avoid mistakes

Land Cover (15 classes): Deciduous Forest

Mapped Current Vegetation Types (109 for Texas Phase 1)

Post Oak Savanna: Post Oak Motte and Woodland
Central Texas: Floodplain Hardwood Forest
Crosstimbers: Post Oak Woodland
Edwards Plateau: Texas Oak/Hardwood Slope Forest
Edwards Plateau: Oak/Hardwood Motte and Woodland
Edwards Plateau: Floodplain Hardwood Forest
Edwards Plateau: Riparian Hardwood Forest
Edwards Plateau: Post Oak Motte and Woodland
Native Invasive: Deciduous Woodland
Native Invasive: Mesquite Woodland and Shrubland
Bastrop Lost Pines: Hardwood Slope Forest
High Plains: Riparian Hardwood Forest

Current Vegetation Types for Victoria Glades Area in Missouri:

-13 land cover types

-60 mapped current vegetation types

3 Urban Low Intensity

5 Cropland

6 Grassland
- Bottomland: Herbaceous Vegetation
- Cultural/Disturbance: Upland Limestone/Dolomite and Chert Grassland
- Cultural/Disturbance: Upland Loess and Till Grassland
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (grassy)

7 Deciduous Forest
- Bottomland Forest: Mixed Bottomland Hardwood Forest
- Bottomland Forest: Sycamore, Cottonwood, Elm, Ash Hackberry Riverfront Forest
- Ozark Highlands: Mesic Backslope and Valley Red Oak/White Oak-Sugar Maple/Basswood Forest
- Ozark Highlands: Chert Backslope White Oak/Black Oak-Dogwood Woodland and Forest
- Ozark Highlands: Chert Upland Post Oak-Bluestem Prairie and Savanna (wooded)
- Ozark Highlands: Limestone/Dolomite Backslope White Oak/Chinquapin Oak-Dogwood Woodland and Forest
- Ozark Highlands: Limestone/Dolomite Upland Chinquapin Oak-Post Oak/White Oak Woodland
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (deciduous woods)
- Ozark Highlands: Loess and Till Upland Post Oak/White Oak-Black Oak Woodland

8 Evergreen Forest
- Bottomland: Successional Eastern Redcedar Woodland
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (juniper or mixed woods)
- Successional Upland Eastern Redcedar Evergreen Woodland and Forest

9 Mixed Forest
- Bottomland: Successional Eastern Redcedar-Deciduous Mixed Woodland and Forest
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (juniper or mixed woods)
- Successional Upland Eastern Redcedar-Deciduous Mixed Woodland and Forest

10 Deciduous Woody-herbaceous
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (deciduous woods)
- Successional Upland Deciduous Sparse Woodland and Shrubland

11 Evergreen Woody-herbaceous
- Bottomland: Successional Eastern Redcedar Sparse Woodland and Shrubland
- Ozark Highlands: Limestone/Dolomite Upland Glade/Chinquapin Oak Woodland Complex (deciduous woods)
- Successional Upland Eastern Redcedar Evergreen Sparse Woodland and Shrubland

13 Woody-dominated Wetland
- Bottomland: Buttonbush/Black Willow-Water Locust Woody Wetland
- Woody-dominated Wetland (non-riverine)

15 Open Water

Texas Vegetation Classification Project: Interpretive Booklet for Phase I

Texas Parks and Wildlife Department and Texas Natural Resources Information System

Contacts: Kim Ludeke, Duane German, and Jim S

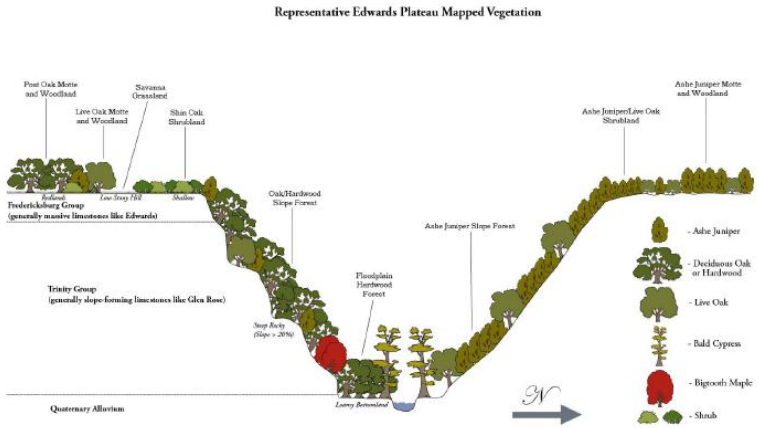
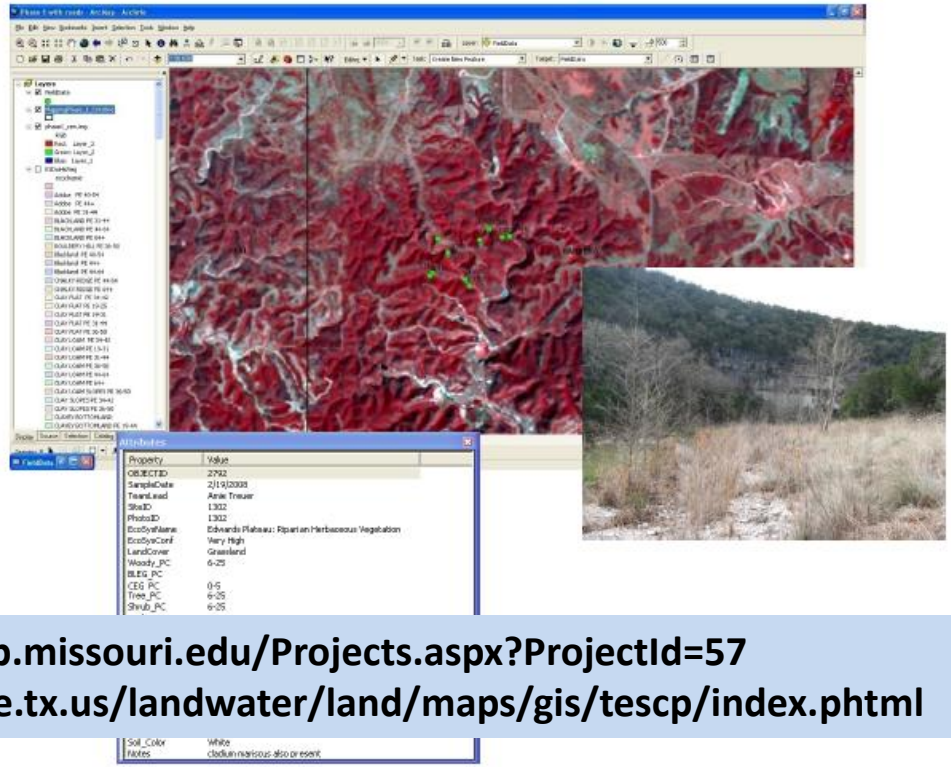


Figure 5. Screen-capture of ground verification data collection database schema, overlay of data collection plots on satellite image, and photograph take at one data plot.



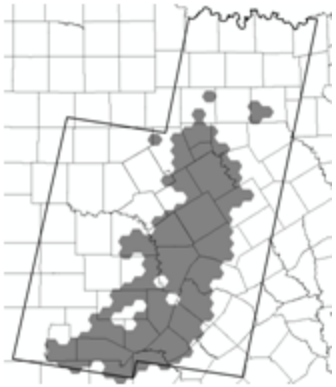
http://morap.missouri.edu/Projects.aspx?ProjectId=57
http://www.tpwd.state.tx.us/landwater/land/maps/gis/tescp/index.phtml

Edwards Plateau: Deciduous Oak / Evergreen Motte and Woodland

Area in Phase 1: 680,115 acres (275,230 ha)

Description of Mapped Type: This mixed woodland type contains significant variation, but deciduous oaks such as Texas oak, white shin oak, or lacey oak (west) are often important in the overstory, together with Ashe juniper, plateau live oak, cedar elm, or sugar hackberry. The understory often contains Ashe juniper and plateau live oak, and Texas persimmon, agarito, and Texas mountain-laurel are common.

Where to Visit:



Balcones Canyonland National Wildlife Refuge: U. S. Fish and Wildlife Service

Government Canyon State Natural Area: Texas Parks and Wildlife Department

Dinosaur Valley State Park: Texas Parks and Wildlife Department

Barton Creek Habitat Preserve: The Nature Conservancy

Honey Creek State Natural Area: Texas Parks and Wildlife Department

Pedernales Falls State Park: Texas Parks and Wildlife Department

Guadalupe River State Park: Texas Parks and Wildlife Department

Barton Creek Greenbelt: City of Austin

Meridian State Park: Texas Parks and Wildlife Department

Ecological Systems Classification

1383 Edwards Plateau Limestone Savanna and Woodland (CES303.660)

Classifiers

Conf.: 2 - Moderate **Classification Status:** Standard
Primary Division: Western Great Plains (303)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Non-Diagnostic Classifiers: Forest and Woodland (Treed); Ridge/Summit/Upper Slope; Sedimentary Rock; Temperate [Temperate Continental]; Unglaciated; Alkaline Soil; Calcareous; Ustic
FGDC Crosswalk: Vegetated, Tree-dominated, Closed tree canopy, Mixed evergreen-deciduous closed tree canopy
National Mapping Codes: EVT 2383; ESLF 4326; ESP 1383

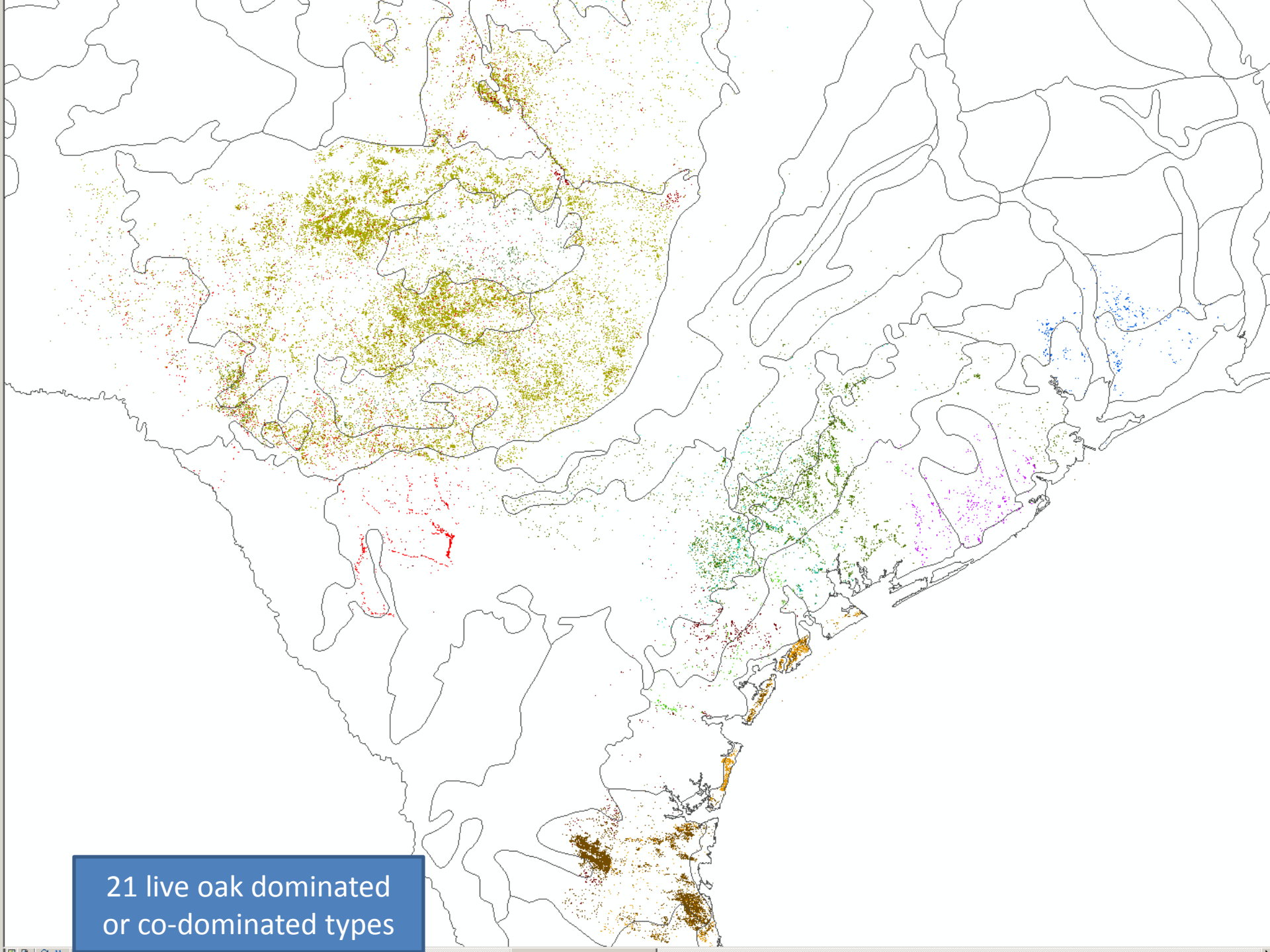
Concept

Summary: This upland system occurs primarily on limestone soils in the Edwards Plateau and forms the matrix within this ecoregion. It can also occur on limestone in the shortgrass regions of Texas and north into Oklahoma in areas such as the Arbuckle Mountains. This system is typified by a mosiac of evergreen oak forests, woodlands and savannas over shallow soils of rolling uplands and adjacent upper slopes within the Edwards Plateau and Lampasas Cutplain. Species such as *Quercus fusiformis* or *Juniperus ashei* dominate the canopy of this system. Other species may include *Quercus buckleyi, Quercus laceyi, Ulmus crassifolia, Fraxinus texensis, Quercus sinuata, Quercus vaseyana*, and *Diospyros texana*. Certain uplands have mottes of *Quercus fusiformis* dominating savanna-like woodlands. Understory species can contain various species of *Bouteloua, Schizachyrium scoparium, Nassella leucotricha*, and/or *Carex planostachys*. Grasslands dominated by *Schizachyrium scoparium* occur in small patches within more closed woodlands and in larger patches in open savanna-like woodlands with scattered trees. Grasslands in this system tend to grade from short-grass communities in the west to mixed-grass communities to the east. Substrate (limestone) determines the range of this system within given examples. Some disturbed areas on hard-bedded limestone of the western plateau are now dominated by mesquite woodland. Natural mesquite woodlands are believed to have occurred on the deeper soils of adjacent riparian systems.
Classification Comments: Distribution in Oklahoma needs to be reviewed. This system is described as a mosaic of grassland and woodland communities.
Similar Ecological Systems:

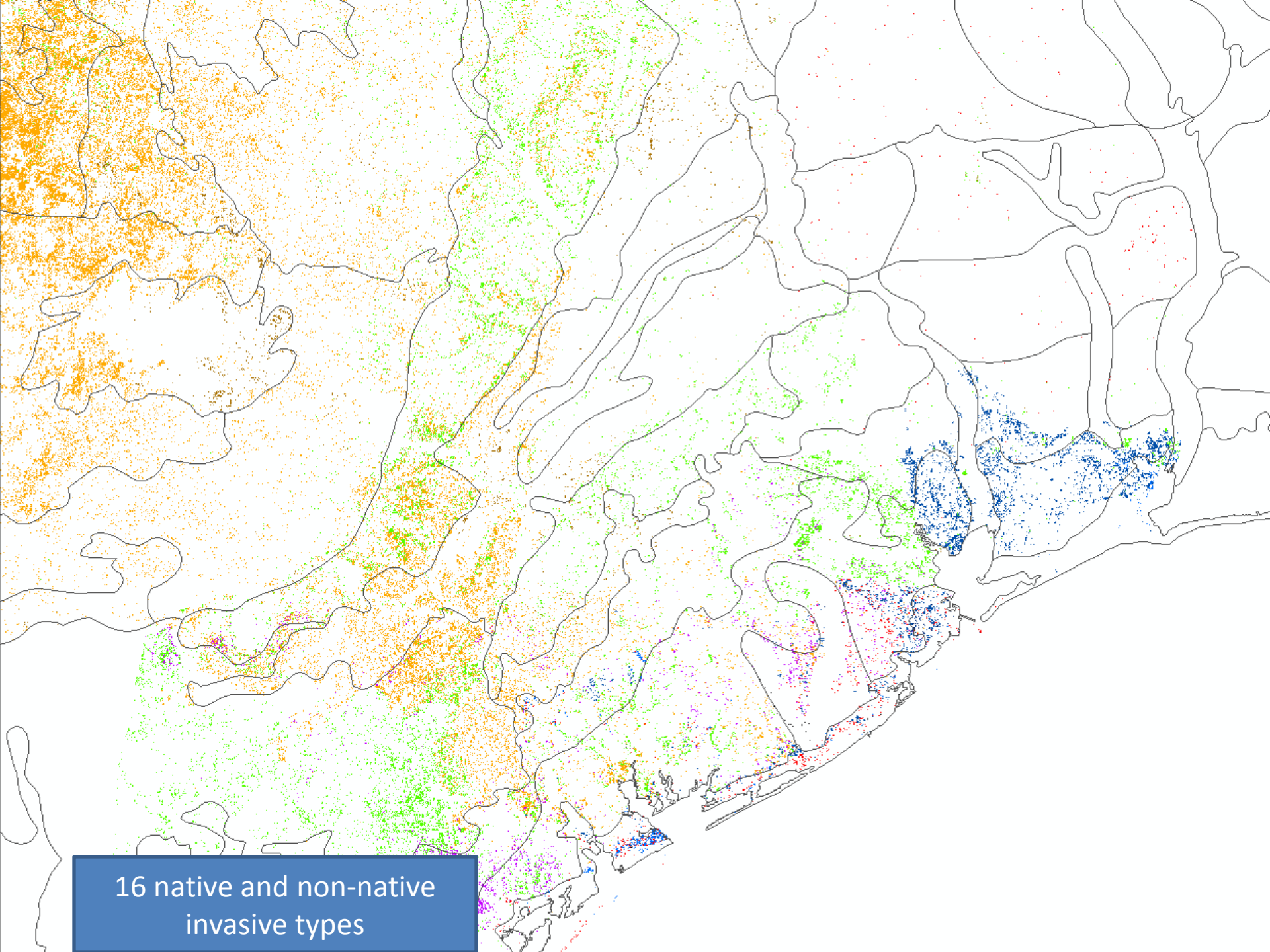
- Edwards Plateau Limestone Shrubland (CES303.041)
- Llano Uplift Granitic Forest, Woodland and Glade (CES303.657)

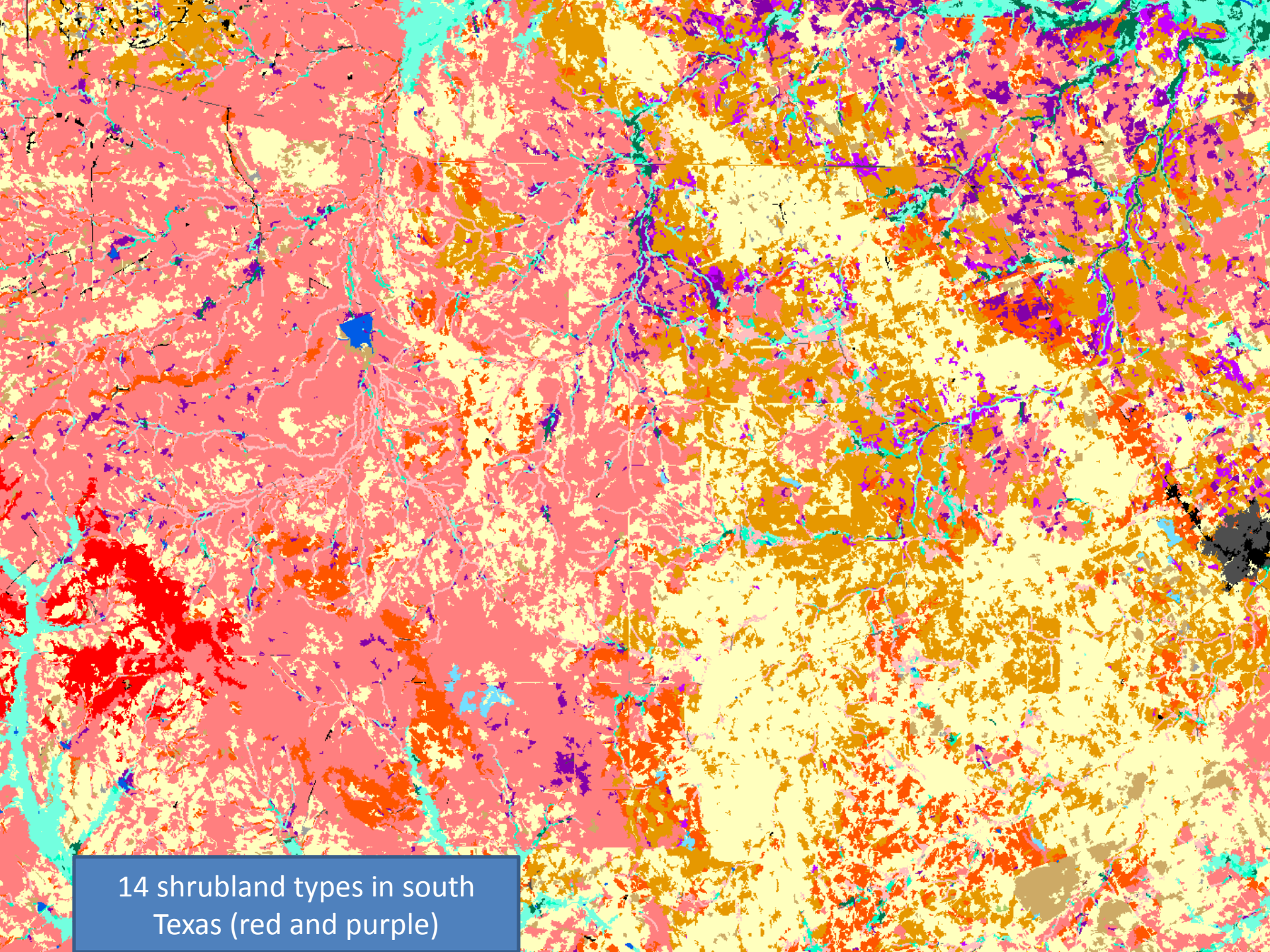
Results & Added Value to Date

- 304 current vegetation types through Phase 4 (NLCD has 15; NatureServe VegMap has 96)
- Minimum 74% to 90% map match with ground data for 210 sampled types (excluding urban & row crops)
- 210 types comprise 88% of the area
- 10 m resolution objects can be manipulated
- Ground-based data collected & summarized
- Interpretive materials; input to NVC



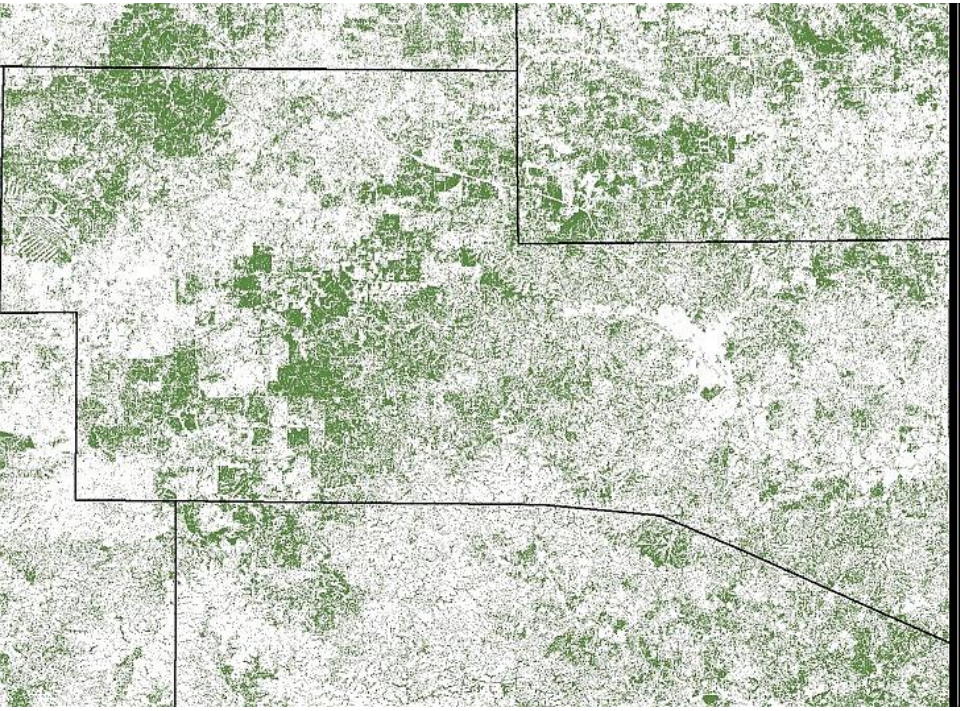
21 live oak dominated or co-dominated types


16 native and non-native invasive types

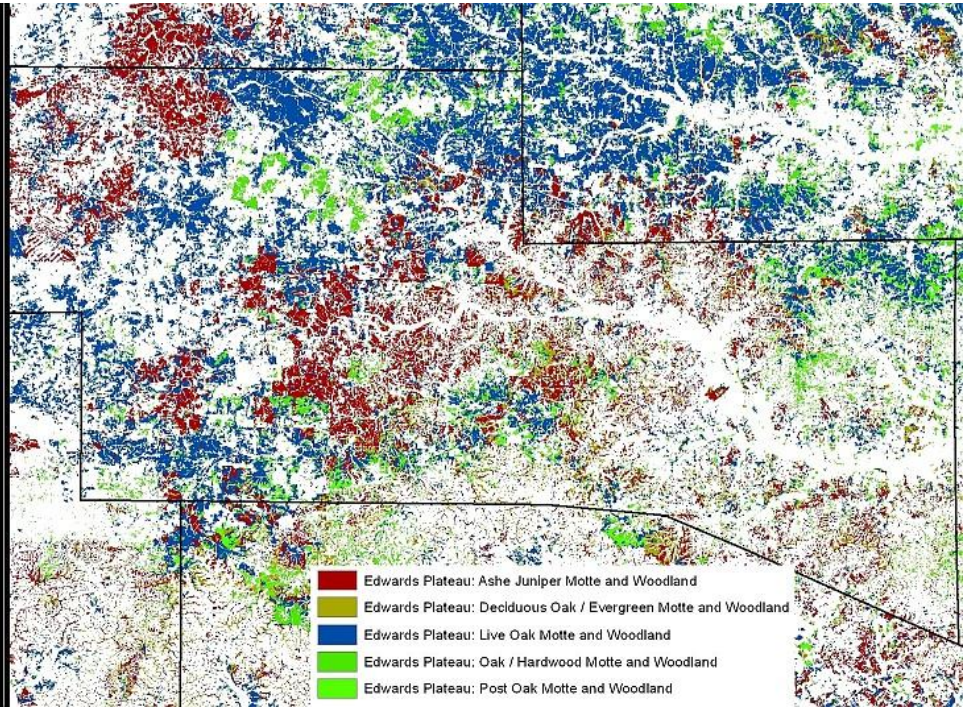


14 shrubland types in south Texas (red and purple)

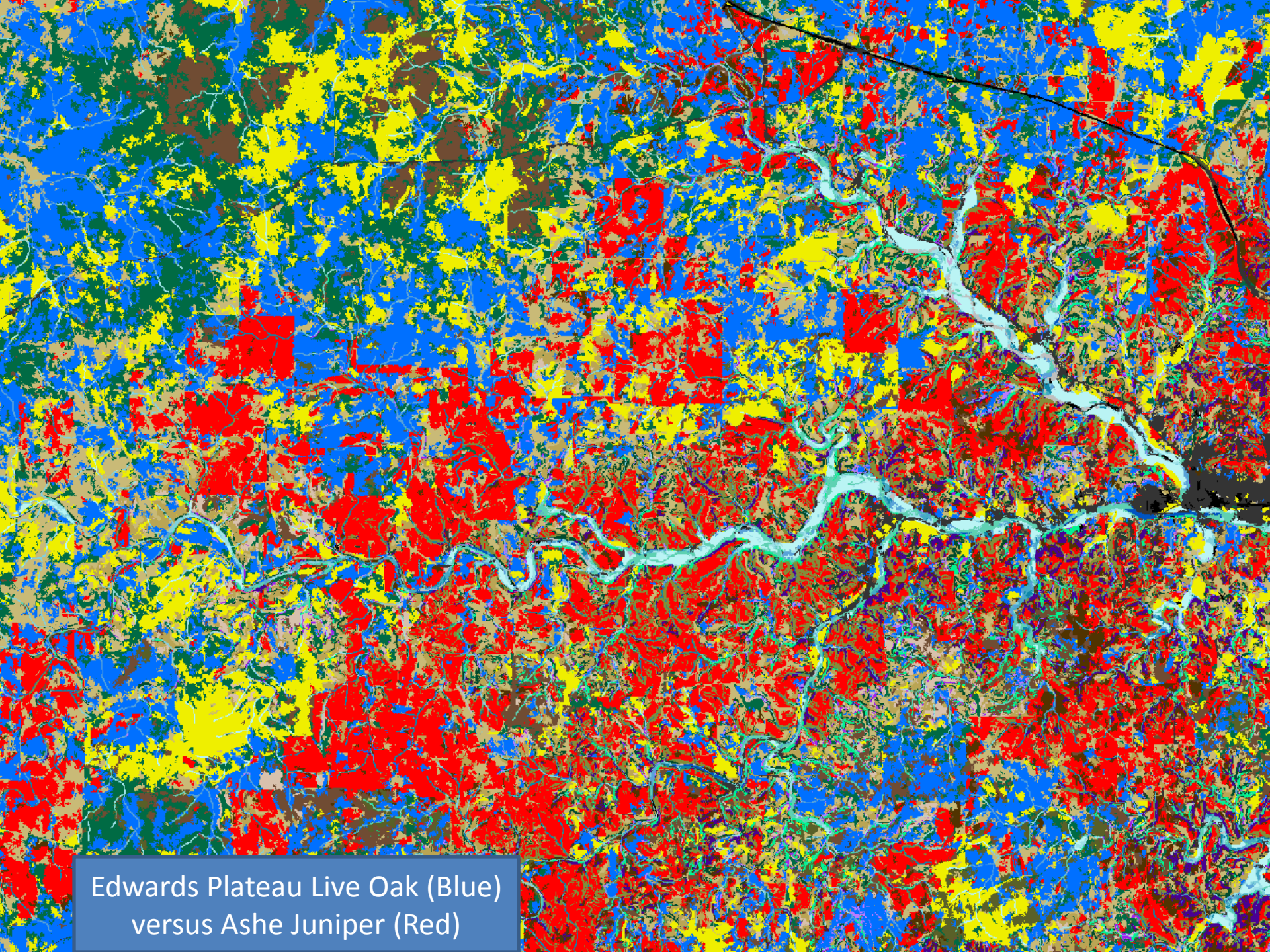
Increased Thematic Resolution on the Edwards Plateau



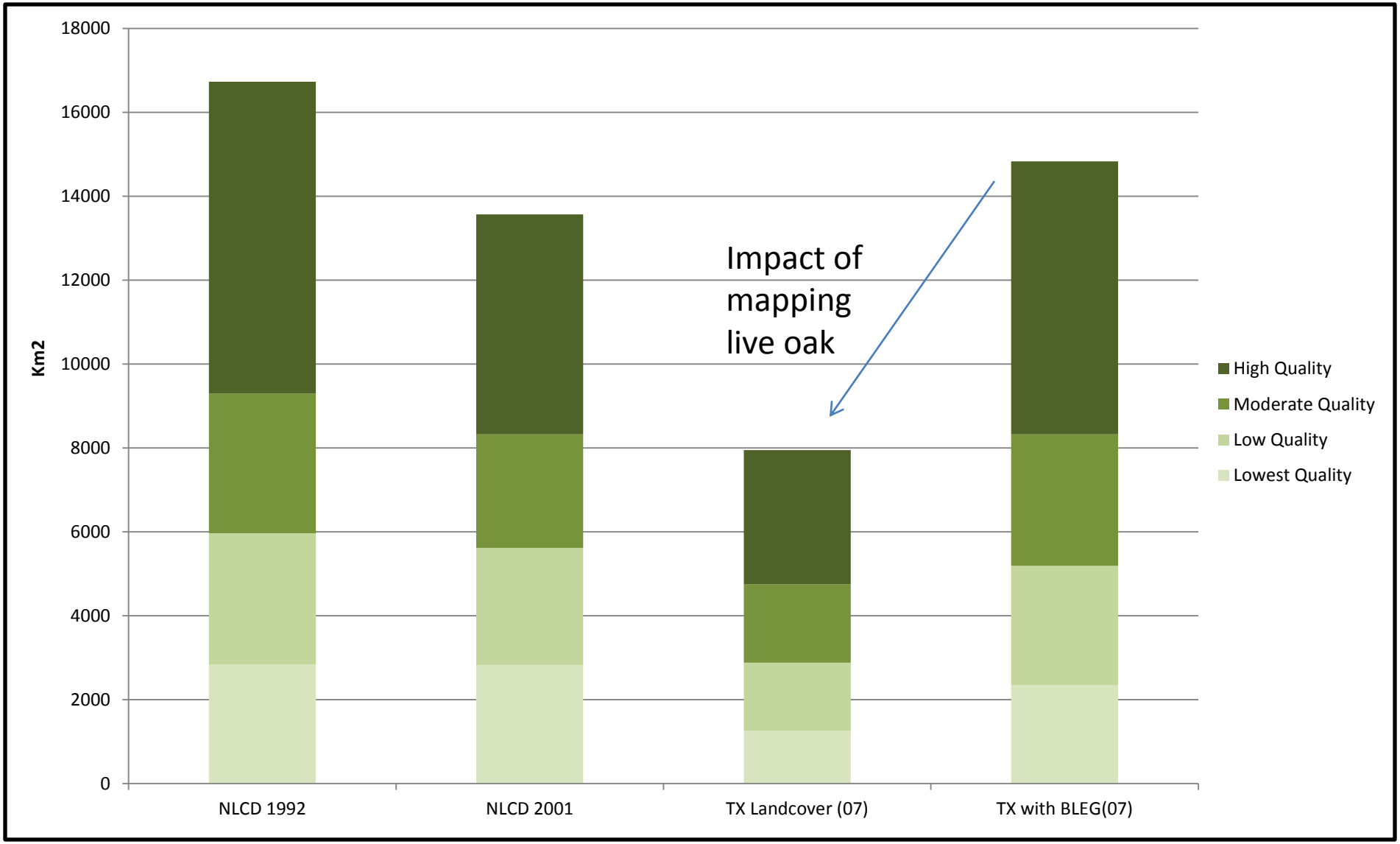
NatureServe VegMap



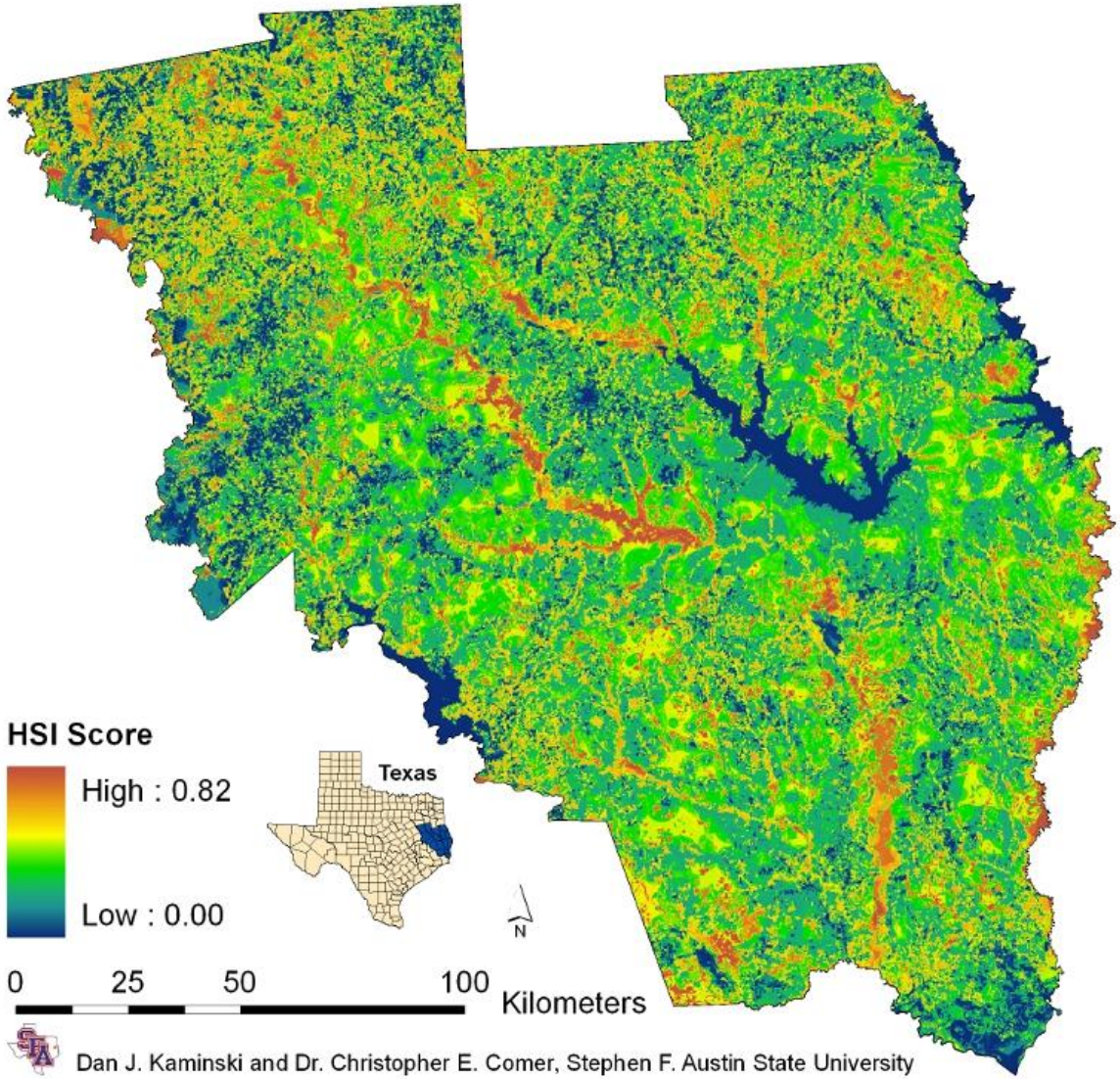
TPWD Current Vegetation Types


Edwards Plateau Live Oak (Blue)
versus Ashe Juniper (Red)

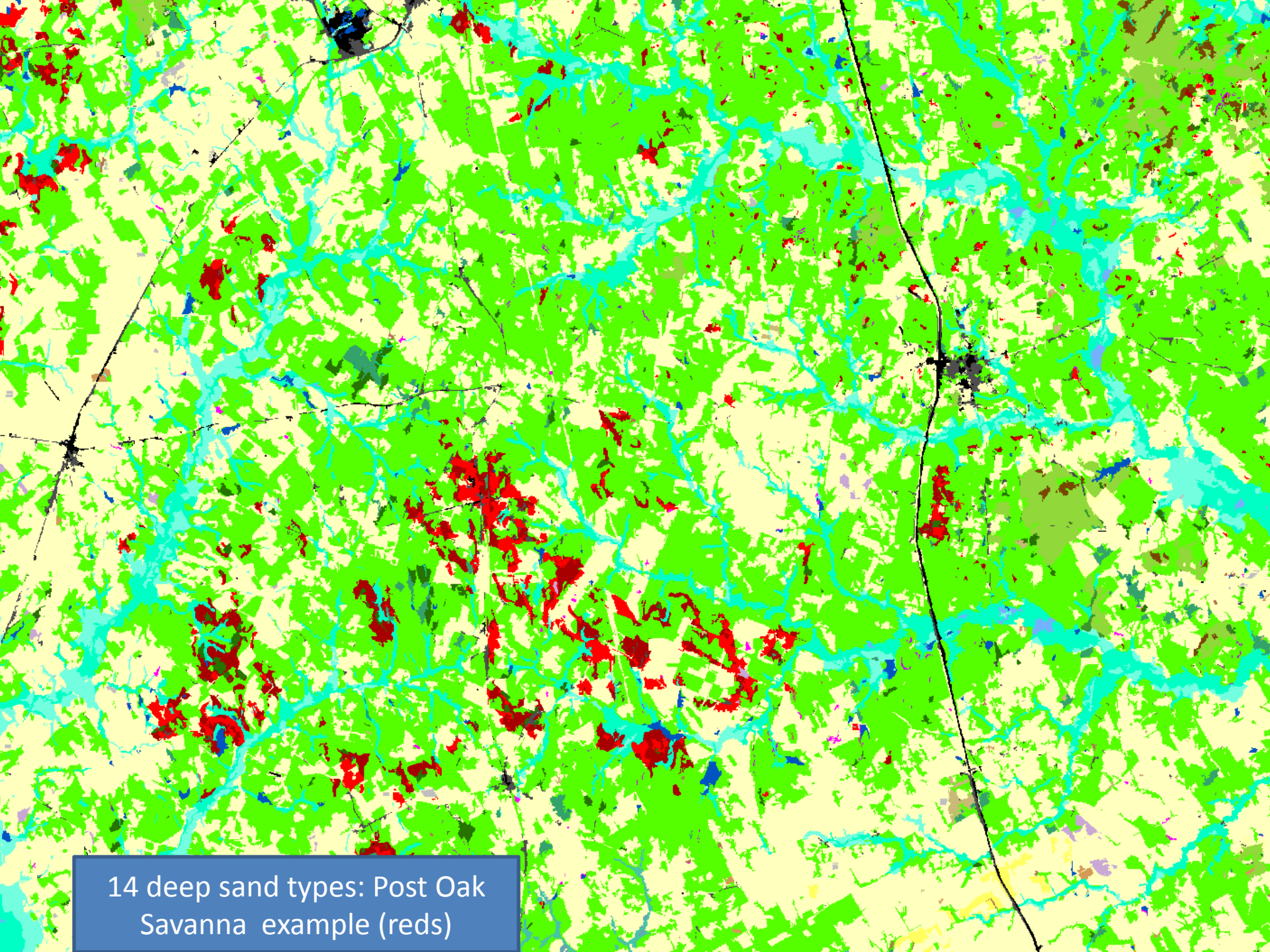
Golden-cheeked Warbler Habitat
Comparing Model using Different Data



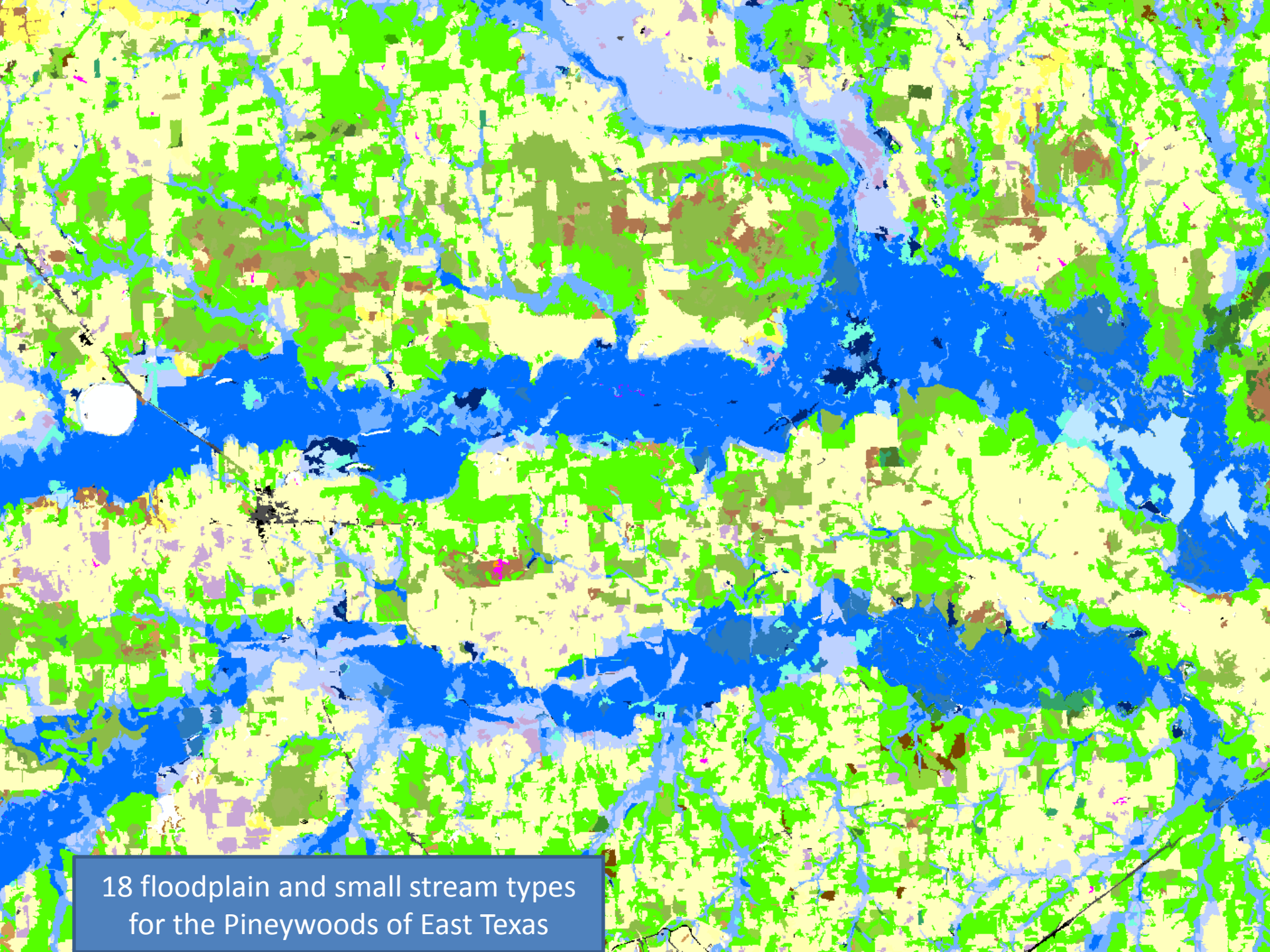
Regional Habitat Assessment and Suitability for Louisiana Black Bear (*Ursus americanus luteolus)* In East Texas



Dan J. Kaminski and Dr. Christopher E. Comer, Stephen F. Austin State University

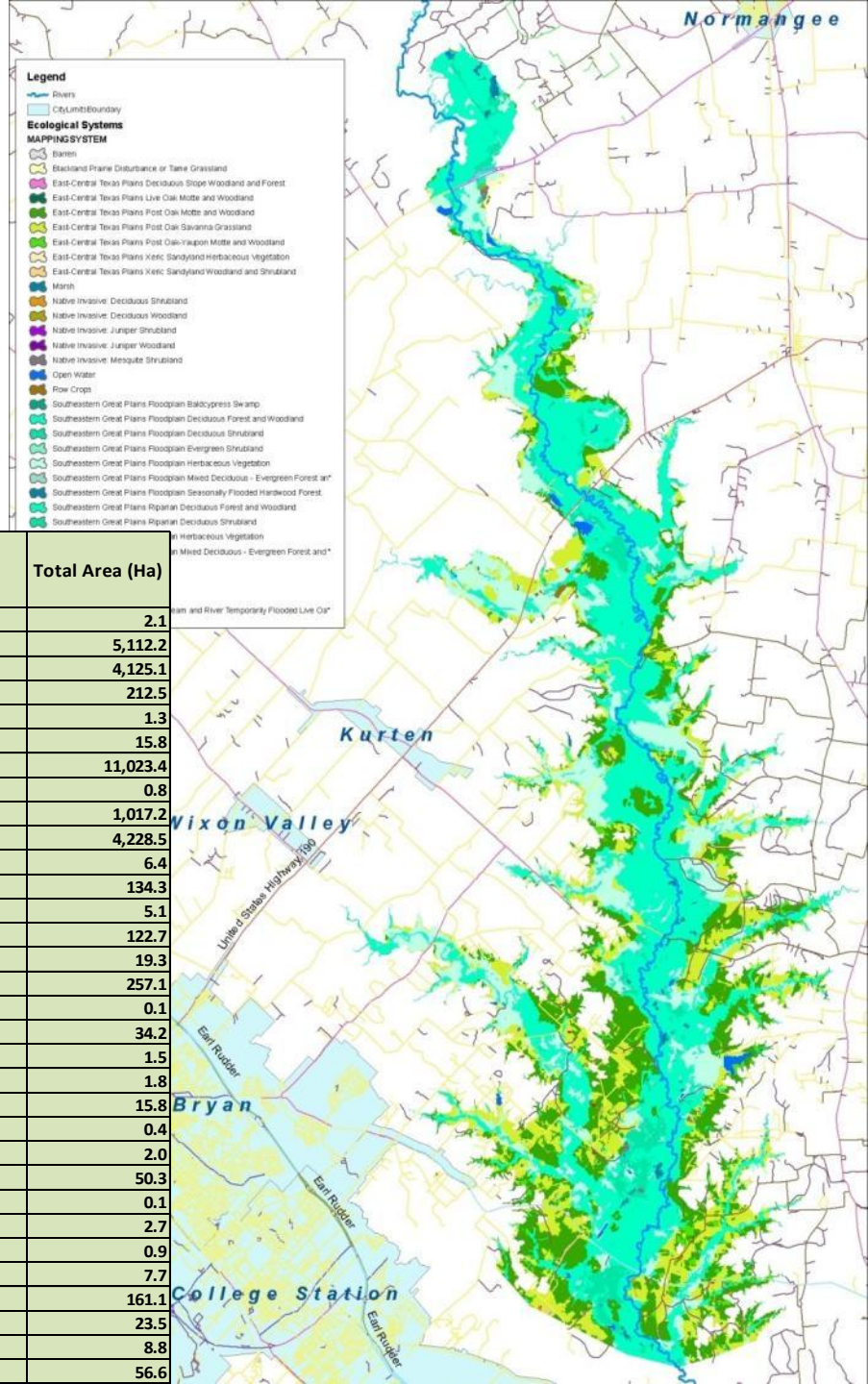


14 deep sand types: Post Oak Savanna example (reds)

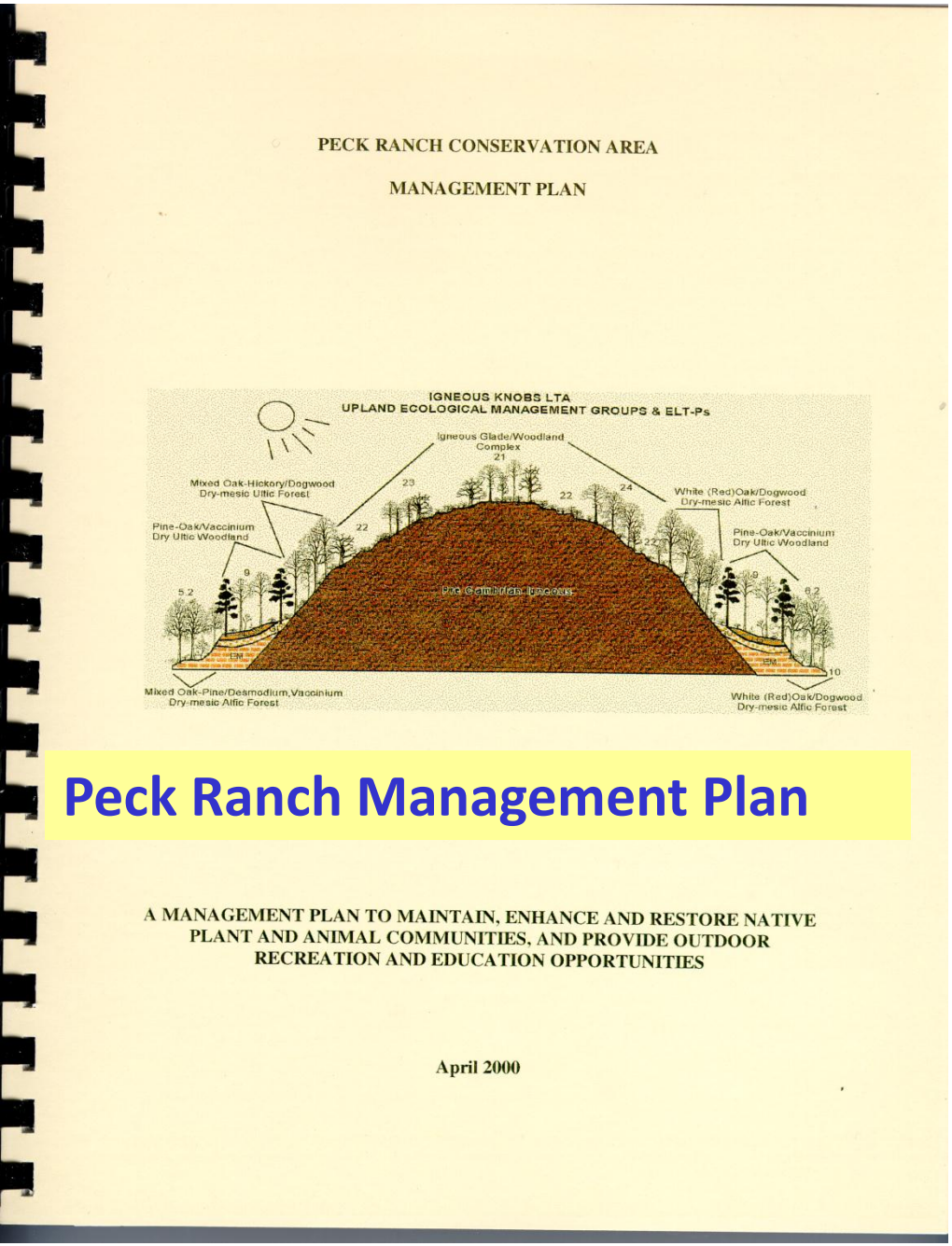


18 floodplain and small stream types for the Pineywoods of East Texas

Rapid Analysis of Potential Reservoir Impact



Number of Pixels	Mapping Sub-System	Total Area (Ha)
212	Post Oak Savanna: Live Oak Motte and Woodland	2.1
511,217	Post Oak Savanna: Post Oak Motte and Woodland	5,112.2
412,505	Post Oak Savanna: Post Oak Savanna Grassland	4,125.1
21,252	Post Oak Savanna: Post Oak-Yaupon Motte and Woodland	212.5
132	Post Oak Savanna: Deciduous Slope Woodland and Forest	1.3
1,579	Southeastern Great Plains Floodplain Mixed Deciduous - Evergreen Forest an*	15.8
1,102,338	Southeastern Great Plains Floodplain Deciduous Forest and Woodland	11,023.4
75	Southeastern Great Plains Floodplain Evergreen Shrubland	0.8
101,717	Southeastern Great Plains Floodplain Deciduous Shrubland	1,017.2
422,848	Southeastern Great Plains Floodplain Herbaceous Vegetation	4,228.5
636	Southeastern Great Plains Floodplain Baldcypress Swamp	6.4
13,429	Southeastern Great Plains Floodplain Seasonally Flooded Hardwood Forest	134.3
506	Southeastern Great Plains Riparian Mixed Deciduous - Evergreen Forest and *	5.1
12,268	Southeastern Great Plains Riparian Deciduous Forest and Woodland	122.7
1,925	Southeastern Great Plains Riparian Deciduous Shrubland	19.3
25,711	Southeastern Great Plains Riparian Herbaceous Vegetation	257.1
11	Pineywoods: Riparian Temporarily Flooded Live Oak Forest	0.1
3,423	Blackland Prairie Disturbance or Tame Grassland	34.2
149	Post Oak Savanna: Xeric Sandyland Woodland and Shrubland	1.5
179	Post Oak Savanna: Xeric Sandyland Herbaceous Vegetation	1.8
1,578	Native Invasive: Deciduous Woodland	15.8
36	Native Invasive: Juniper Woodland	0.4
203	Native Invasive: Juniper Shrubland	2.0
5,034	Native Invasive: Mesquite Shrubland	50.3
13	Native Invasive: Deciduous Shrubland	0.1
273	Marsh	2.7
85	Swamp	0.9
770	Barren	7.7
16,114	Open Water	161.1
2,345	Row Crops	23.5
879	Urban High Intensity	8.8
5,655	Urban Low Intensity	56.6



For Each Park / Ranch / Ecoregion / County:

Acres of Potential Natural Communities

From ELTs

Current Mapped Land Cover

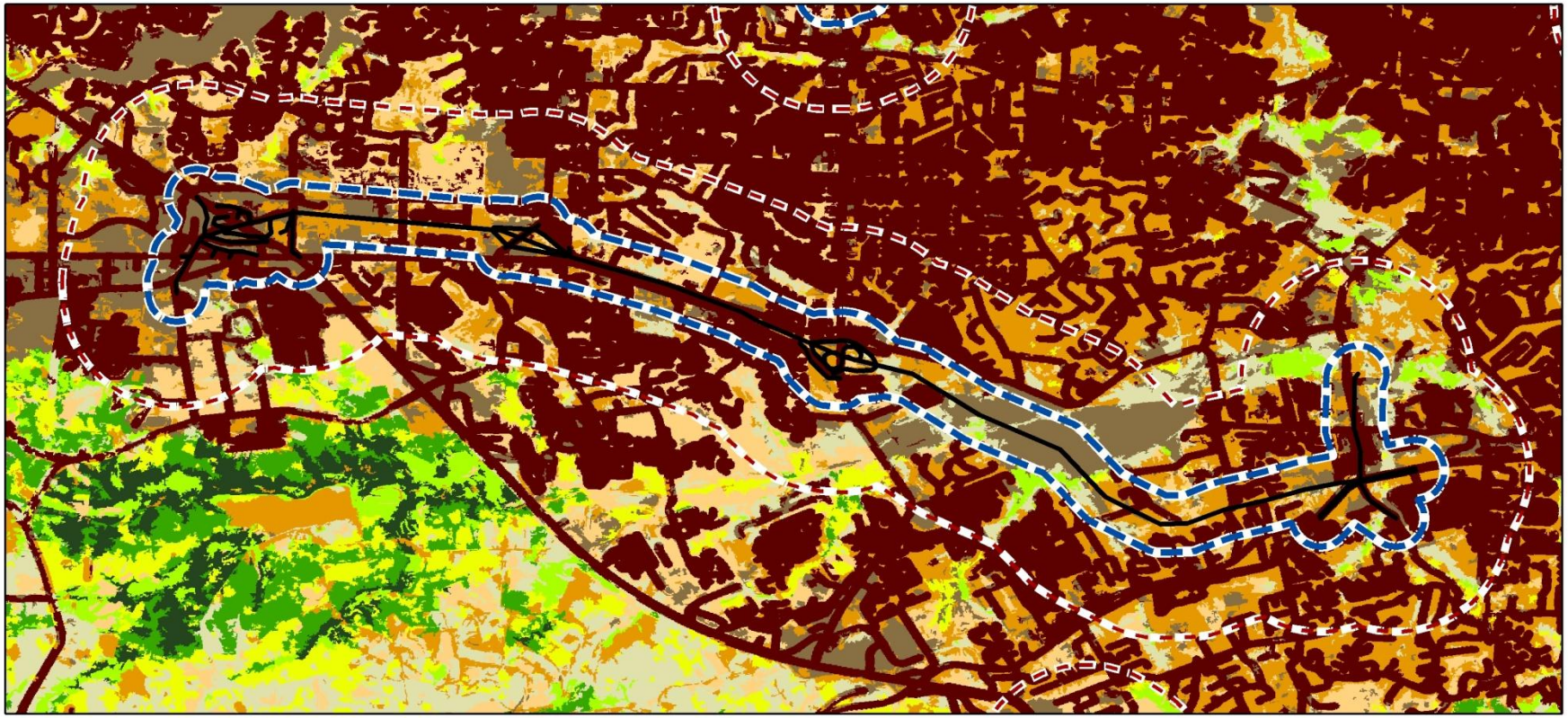
Current Condition and Acres by ELT

Objectives

Desired Future Condition and Acres by ELT

Project #32

Example – Use for Project Scoring, St. Louis: Ecological Significance Value Sums within Buffers



Legend

- Project
- 1/4 Mile Buffer
- 1 Mile Buffer

Ecological Significance

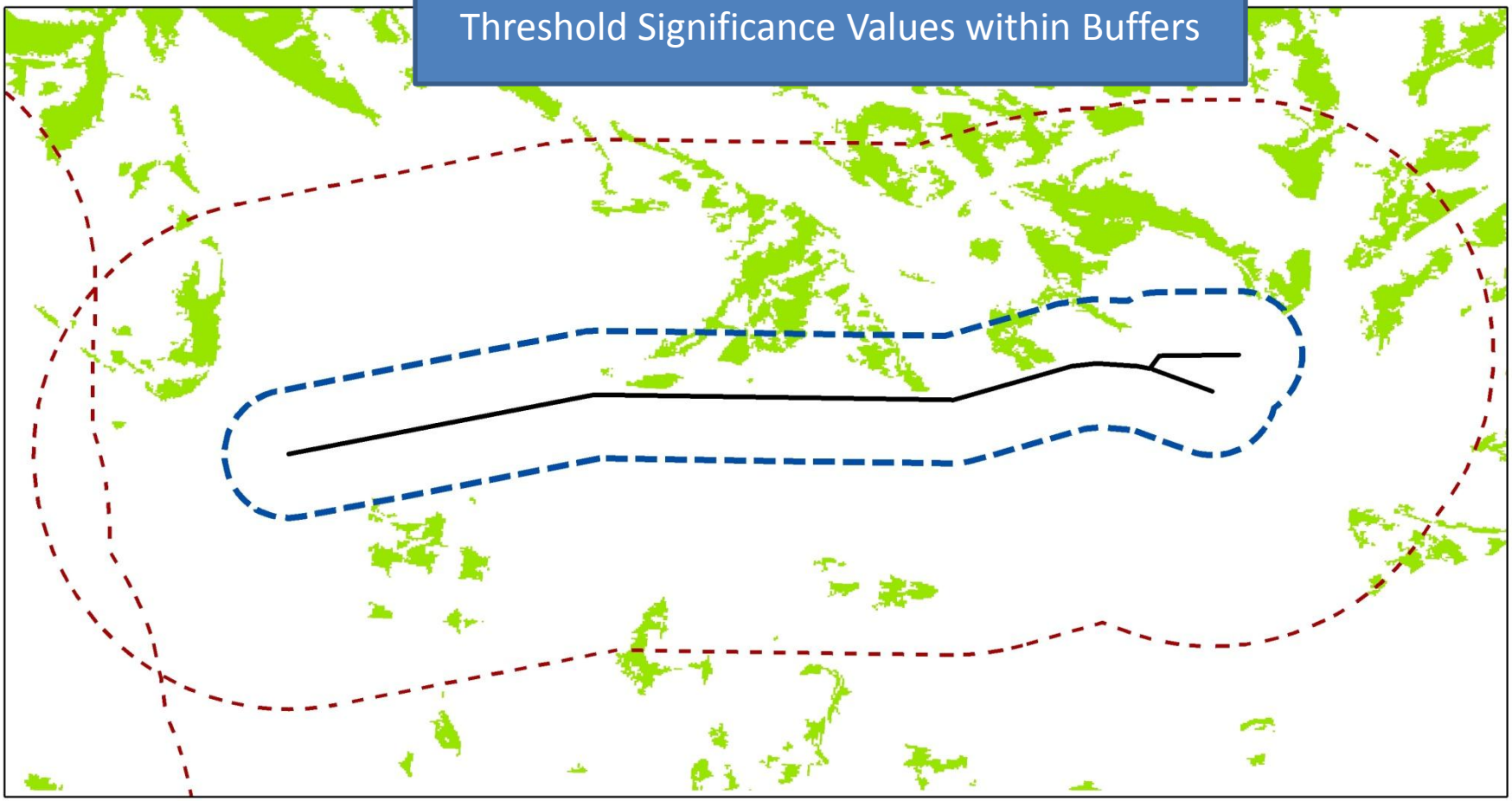
Low 1 2 3 4 5 6 7 8 High 9

Average Ecological Significance Score in 1 Mile Buffer: 2.1

0 0.5 1 Miles

Project #13

Example – Use for Project Scoring, St. Louis: Threshold Significance Values within Buffers



Legend

Project

1/4 Mile Buffer

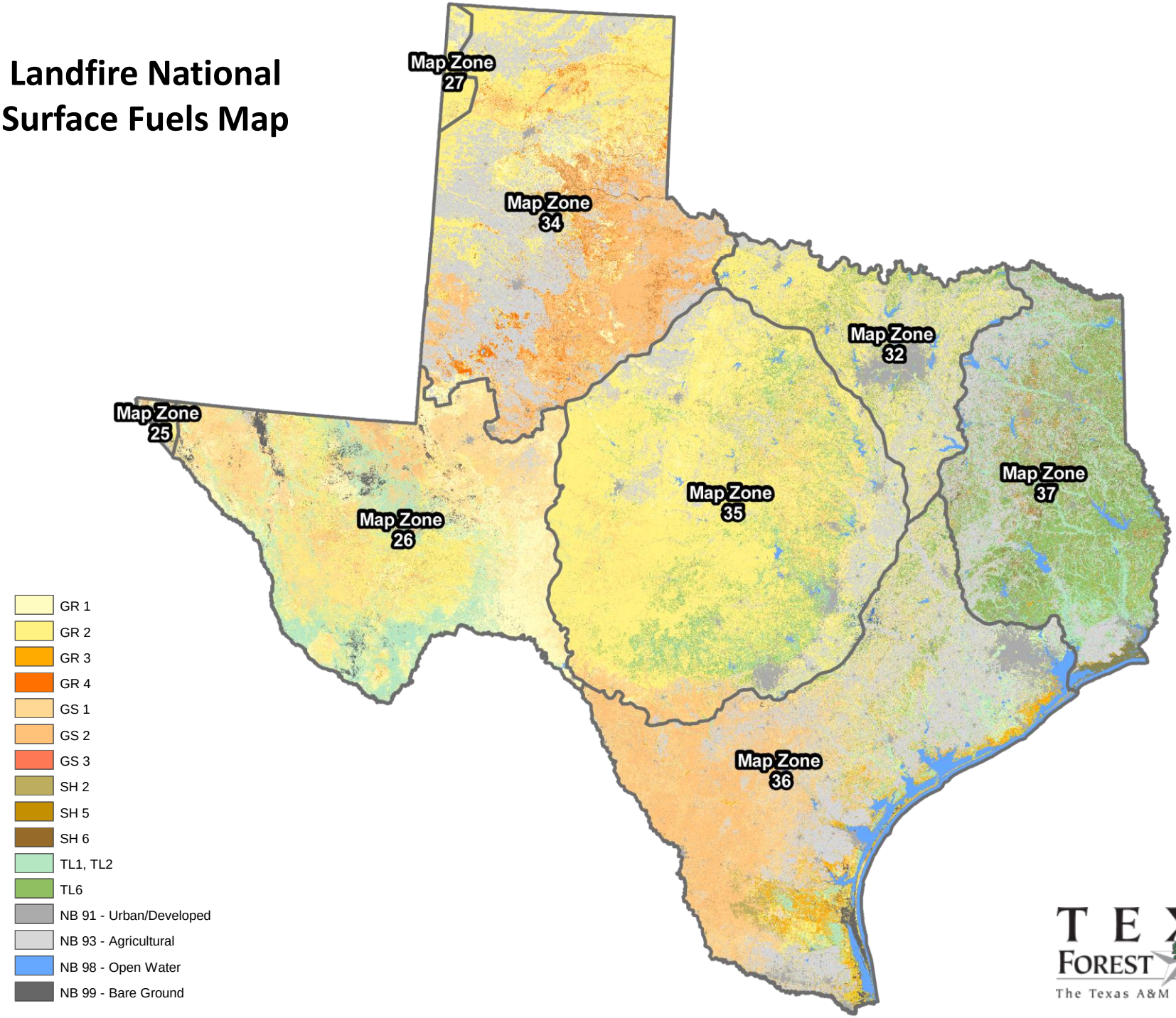
1 Mile Buffer

Ecological Signficance

1 2 3 4 5 6 7 8 9

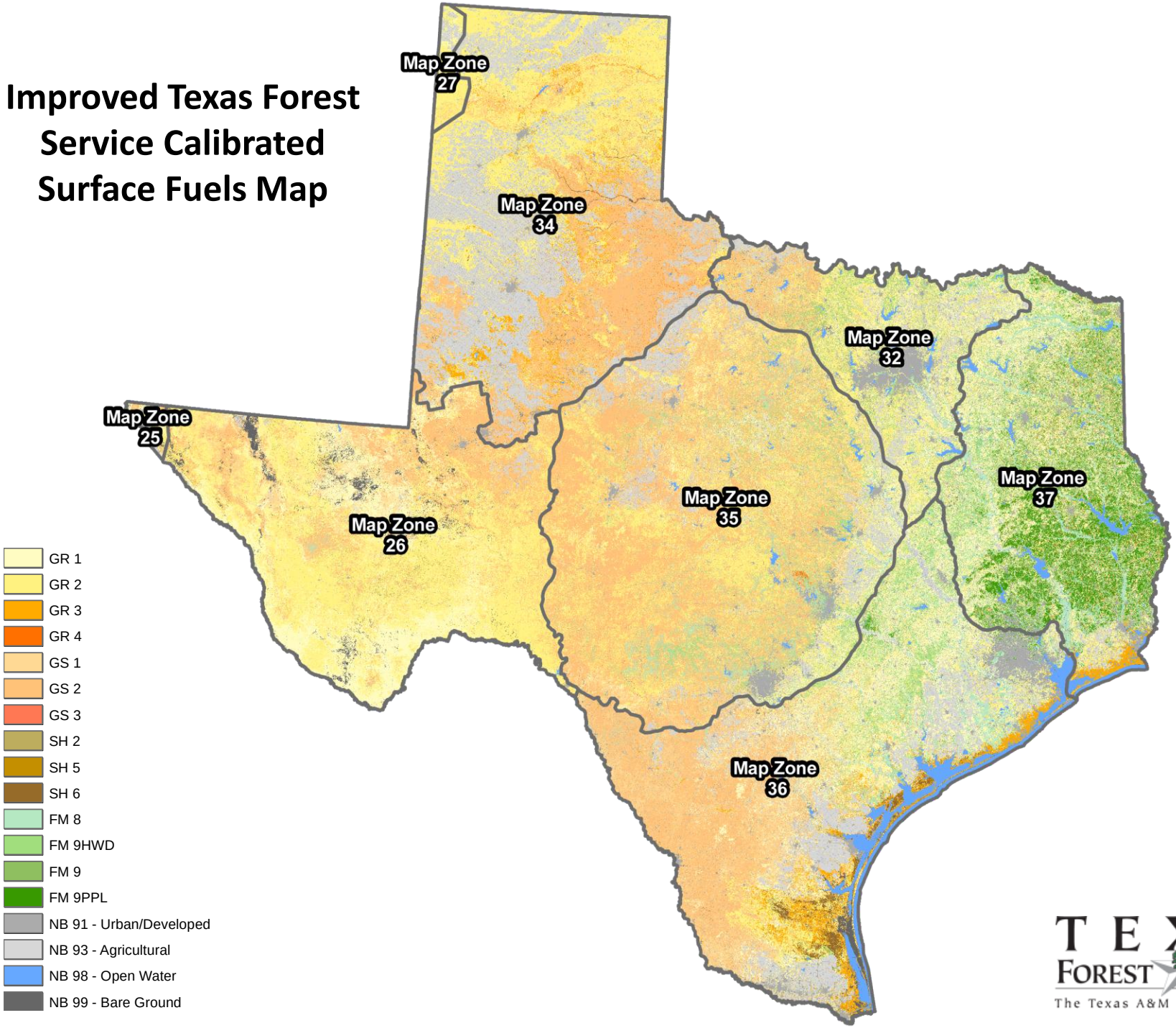
0 0.5 1 Miles

Landfire National Surface Fuels Map



TEXAS FOREST SERVICE
The Texas A&M University System

Improved Texas Forest Service Calibrated Surface Fuels Map



TEXAS FOREST SERVICE
The Texas A&M University System

Summary & Prospects for Oklahoma

- Improved, useful abiotic site type and current vegetation type maps can be produced in a practical way
- Process is conceptually straight-forward but challenging
- Requires right mix of personnel, time, and resources
- Teamwork is essential
- Outcomes will be well-received

Texas Ecological Systems Classification Pro

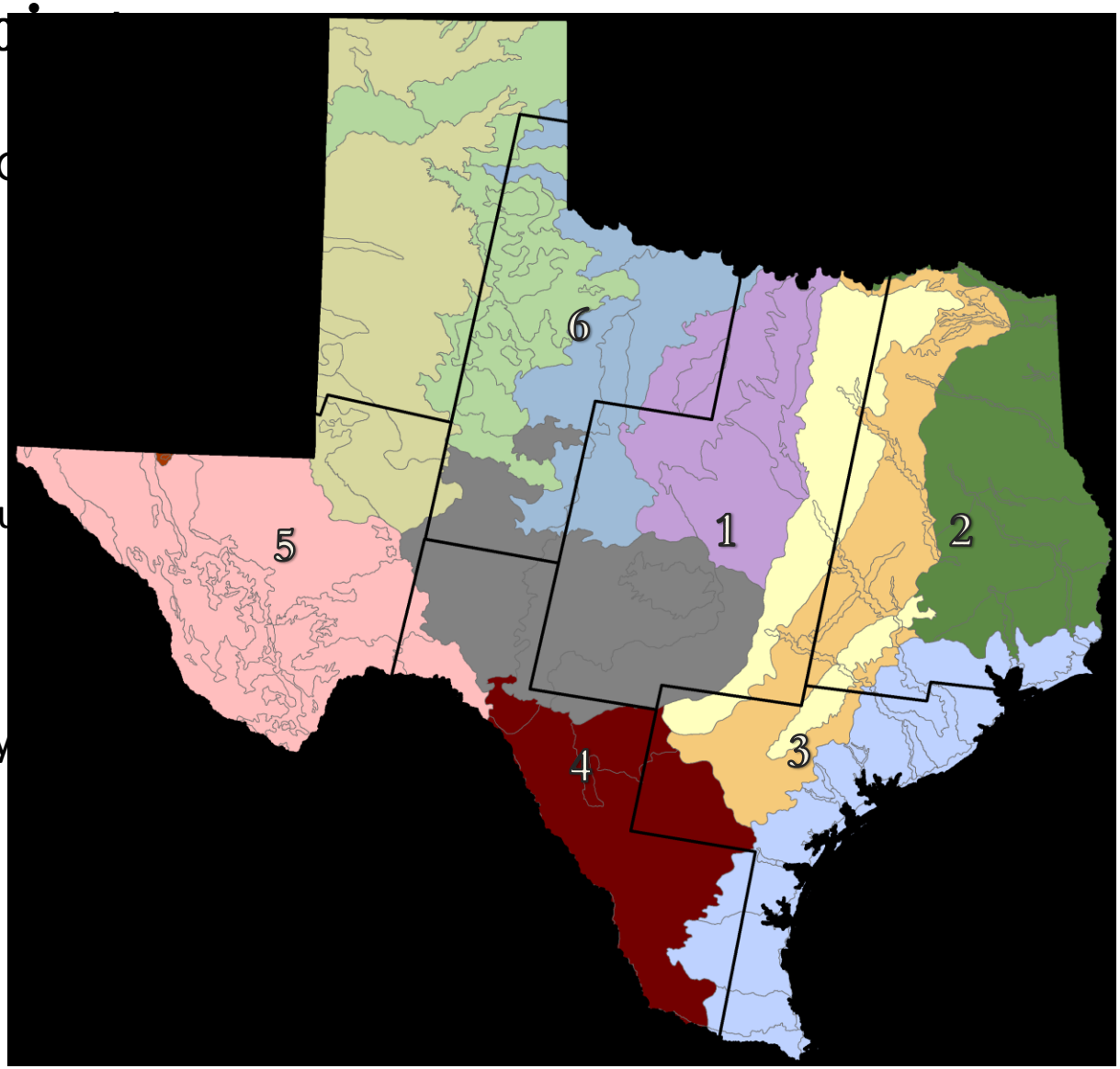
Kim Ludeke, Duane C
Amie Treuer-Kuehn

Jim Scott

David Diamond,
Lee Elliott, Diane Tru
Clayton Blodgett,
Dyanna Pursell

Judy Teague, Milo Py

Bill Carr



http://www.tpwd.state.tx.us/landwater/land/maps/gis/tescp/index.phtml

Contact: David Diamond or Lee Elliott, MoRAP
Duane German, TPWD
diamondd@missouri.edu