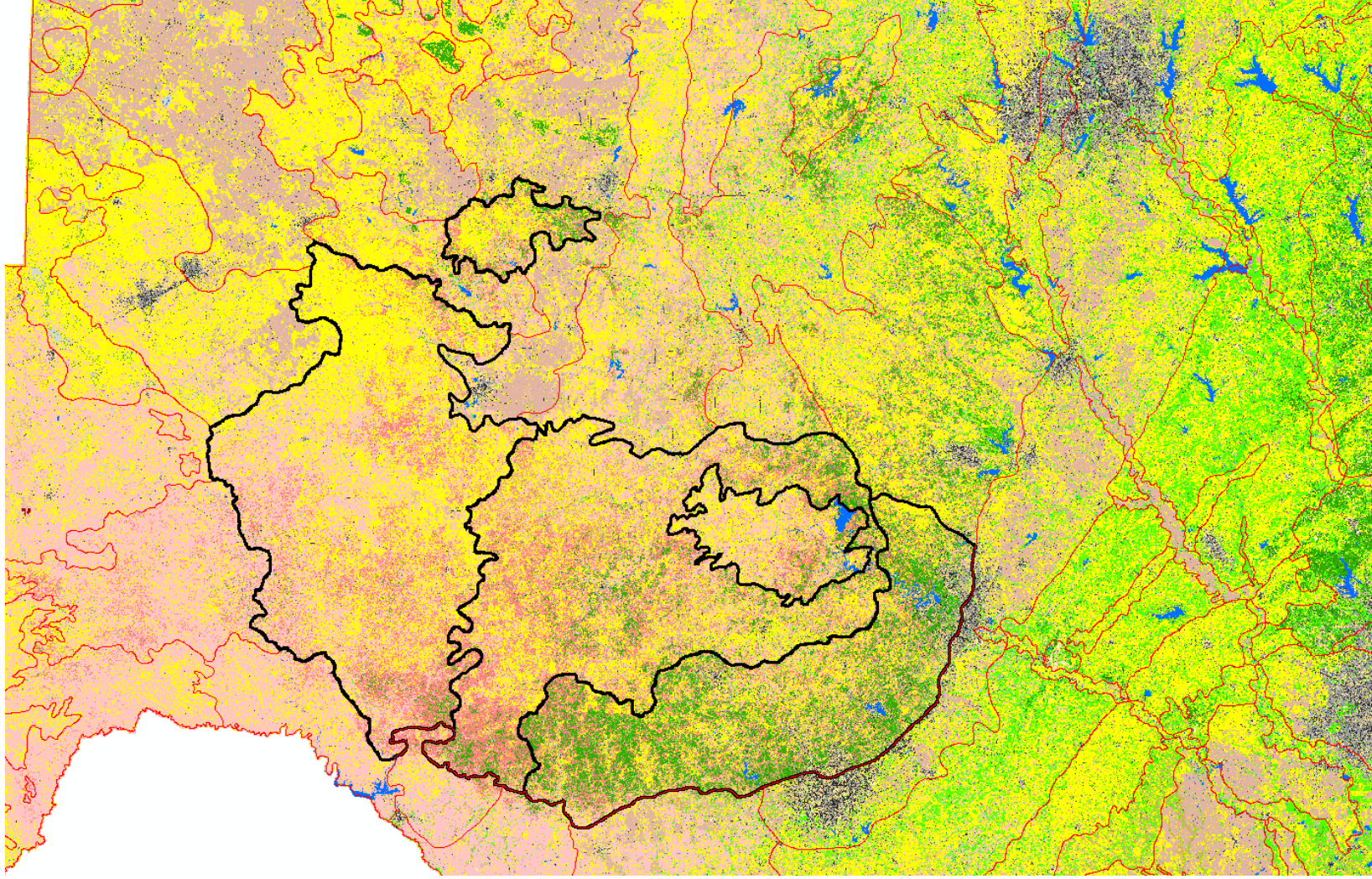
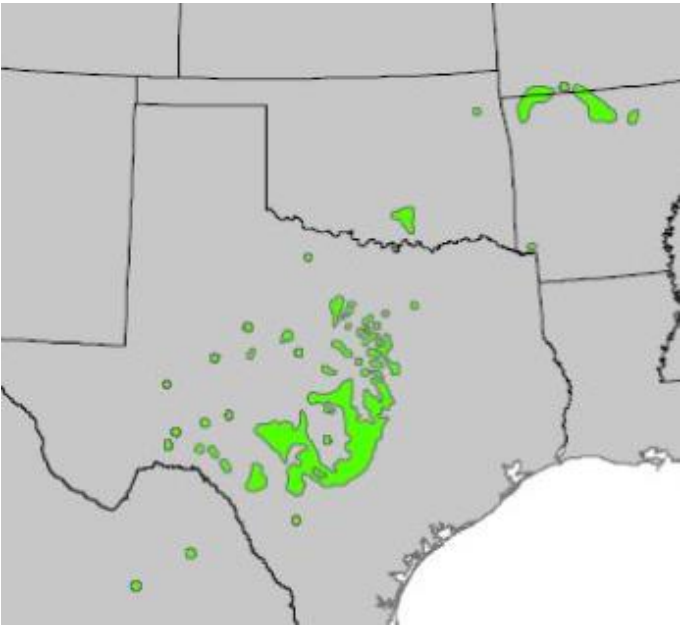
Edwards Plateau Vegetation Patterns



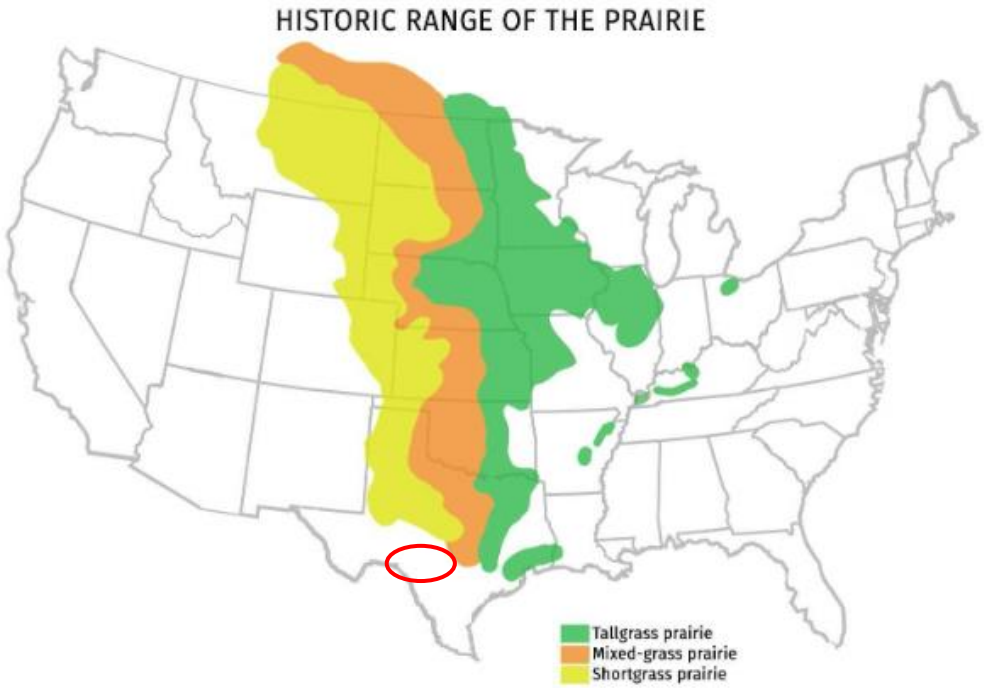
Ashe's Juniper Range Map

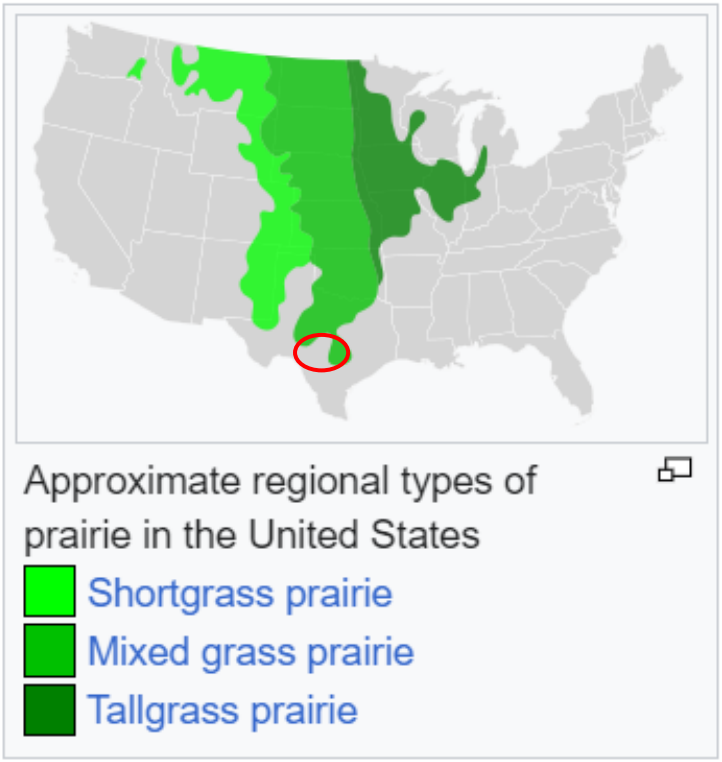


May 8, 2024

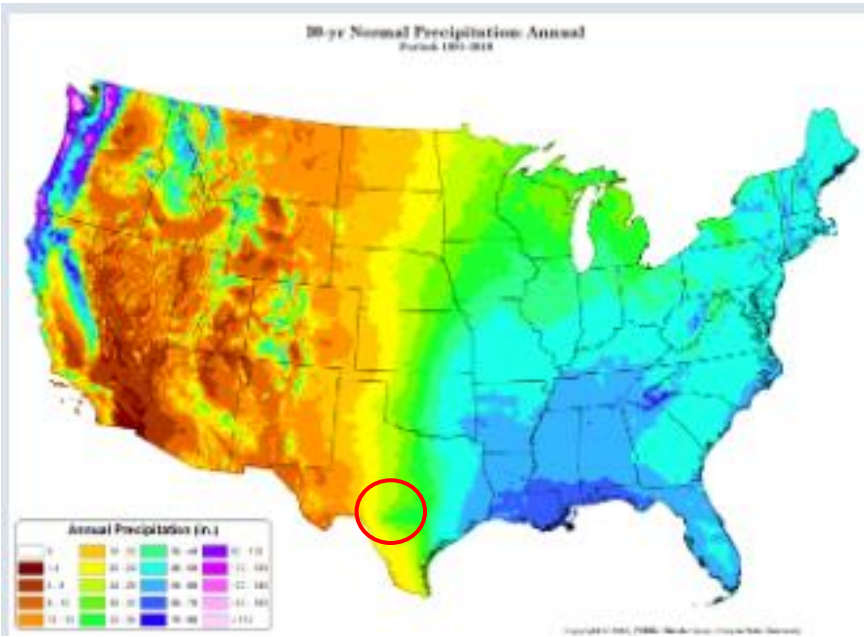
David Diamond & Duane German

Contact:
diamondd@missouri.edu





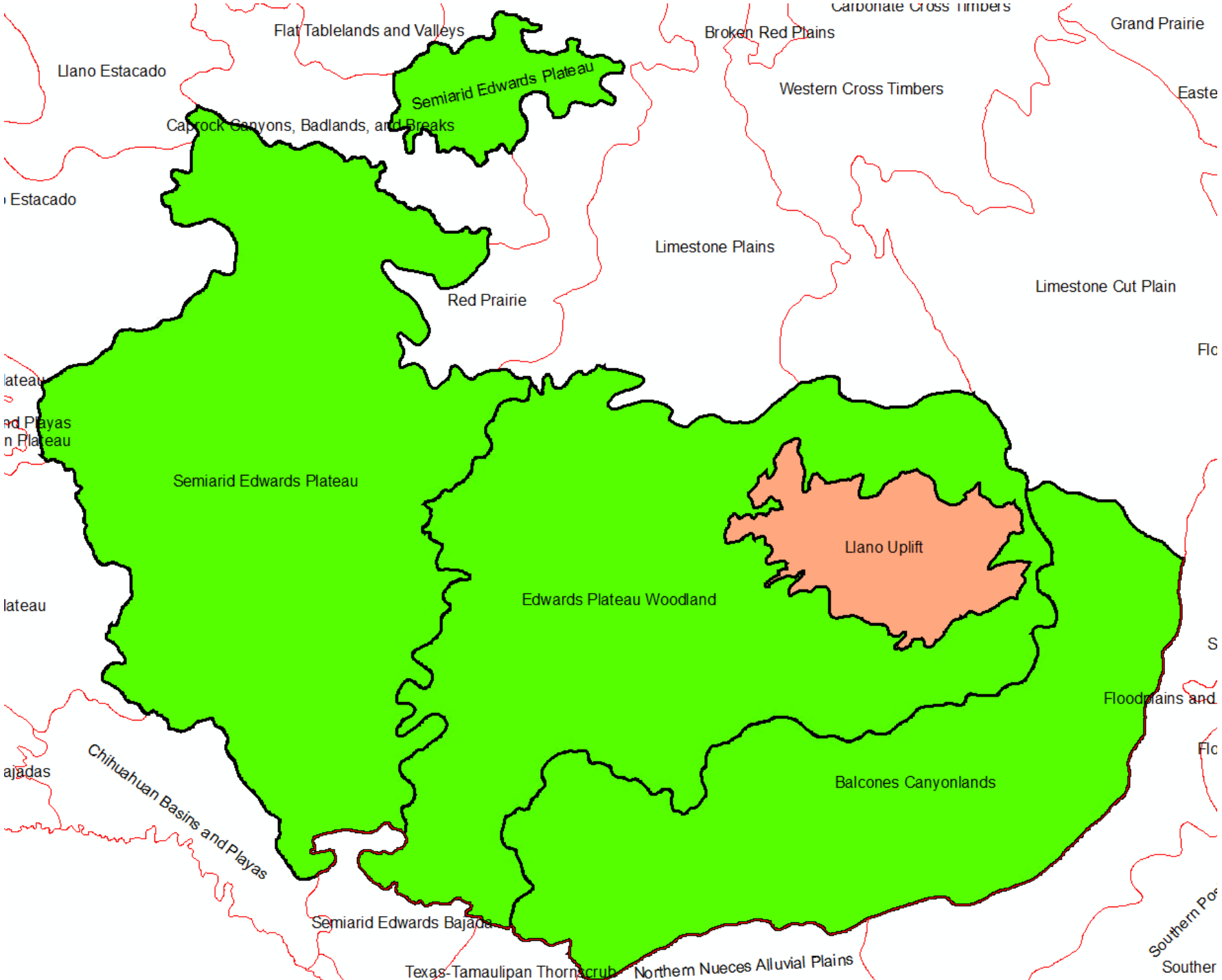
USFS Tree Density



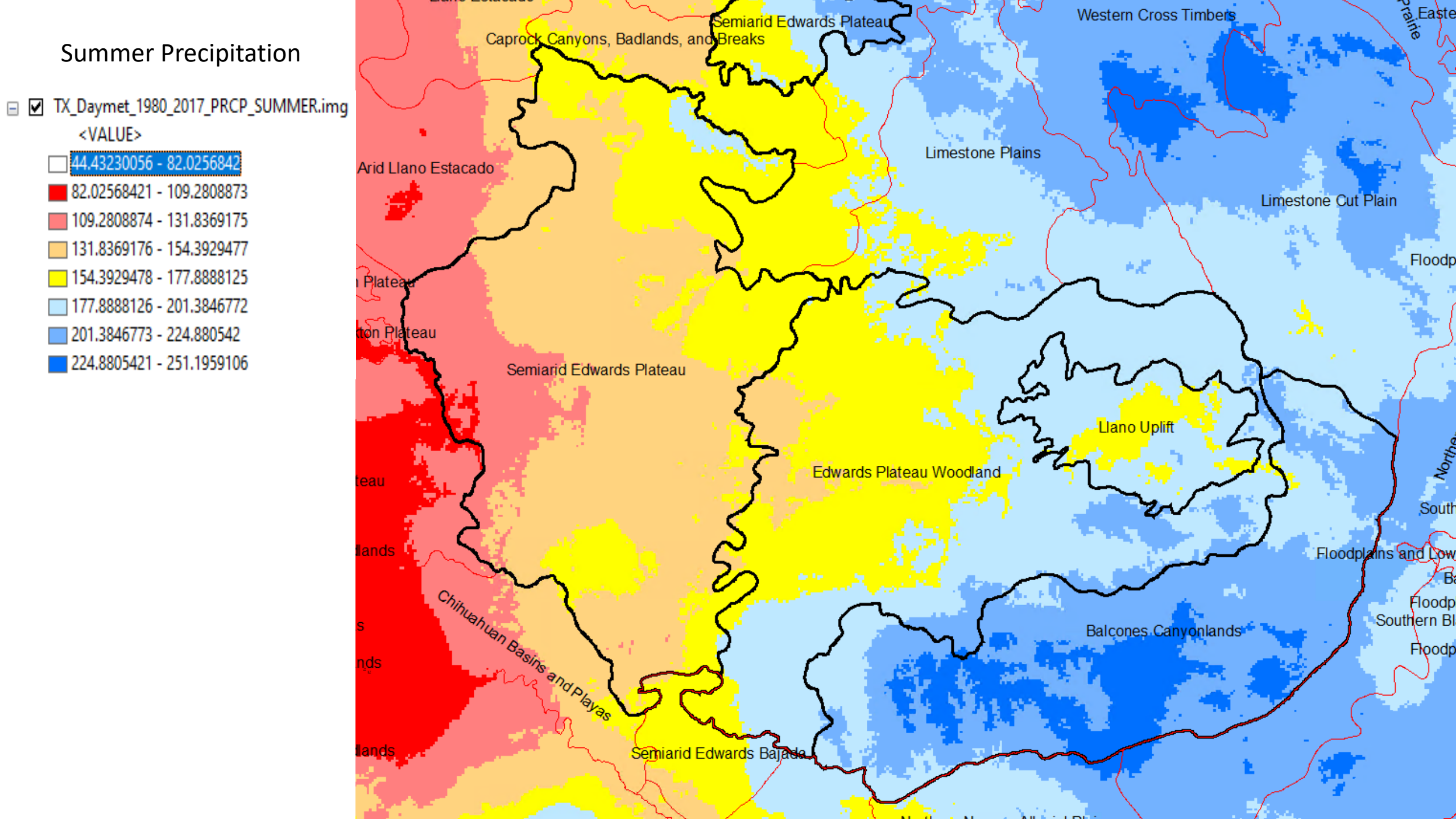
EPA Level 3 Edwards Plateau Ecoregion (colored area)

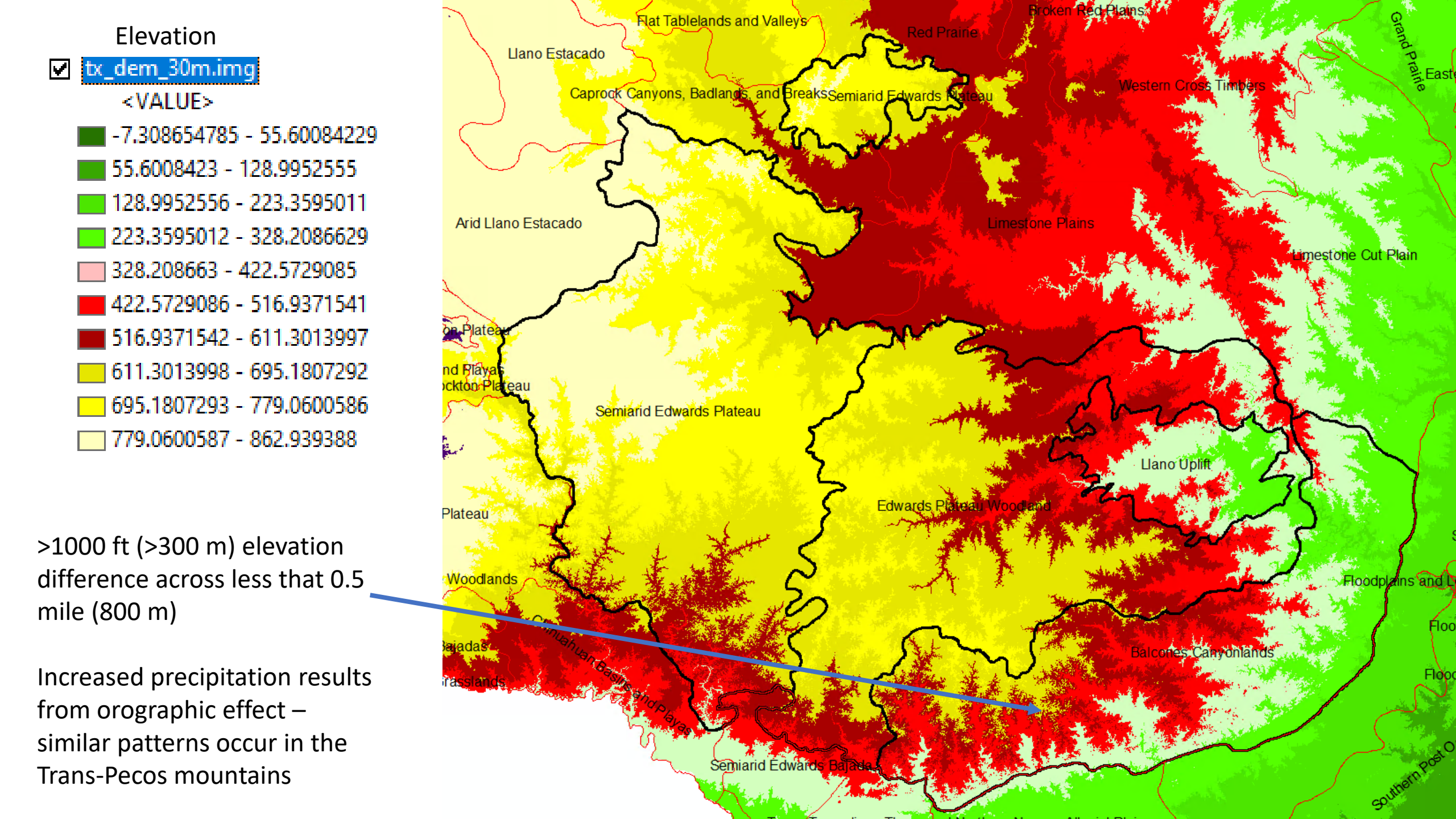
Level 4 Ecoregions labeled

Llano Uplift (pink) is a topographic basin with acidic substrate vs limestone for the other ecoregions (green) so vegetation is quite different



Summer Precipitation





>1000 ft (>300 m) elevation difference across less that 0.5 mile (800 m)

Increased precipitation results from orographic effect – similar patterns occur in the Trans-Pecos mountains

Slopes >20%

EPA Level 4 Ecoregions

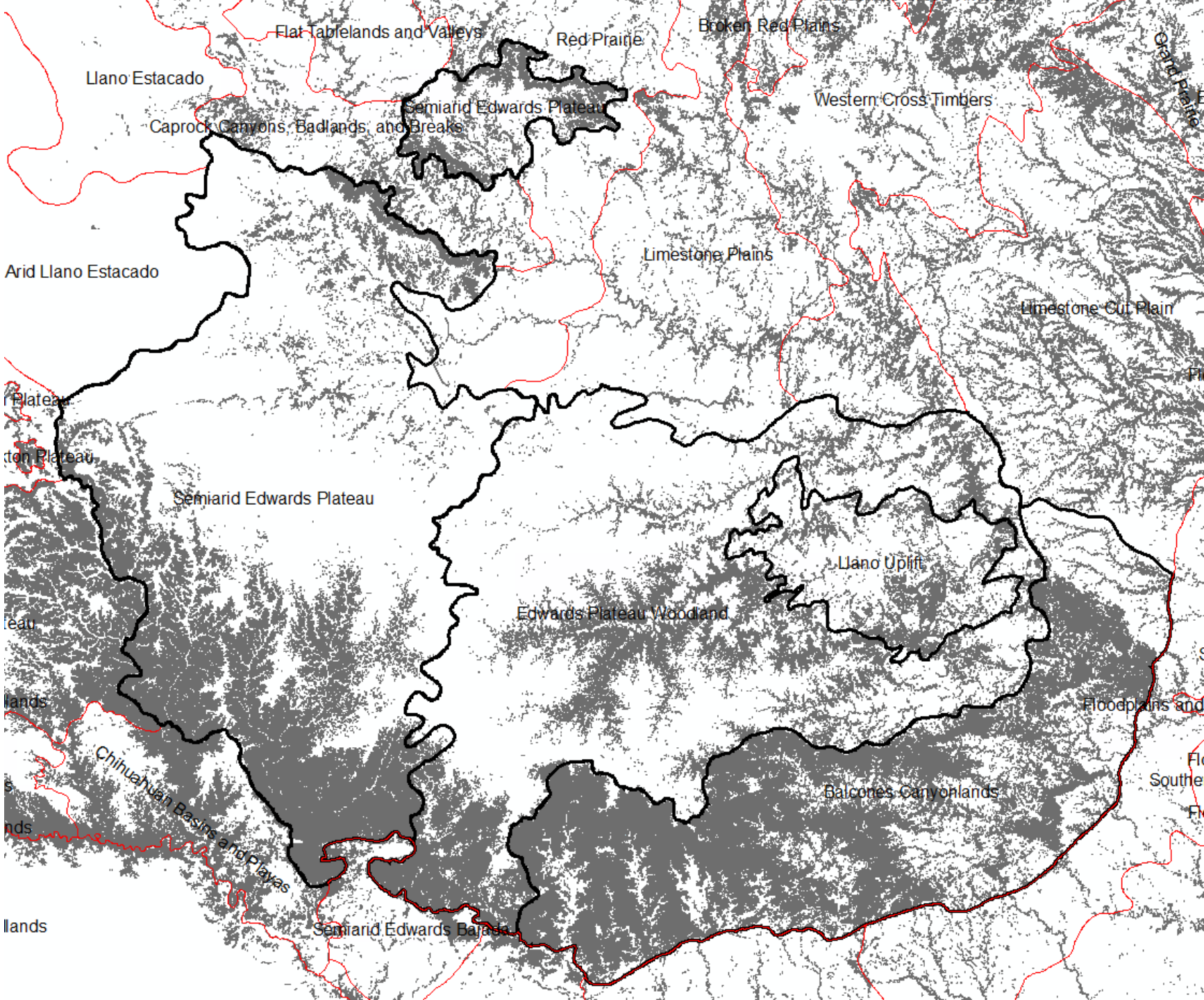
Balcones Canyonlands is wet and rough

Edwards Plateau Woodland is medium-wet and relatively smooth

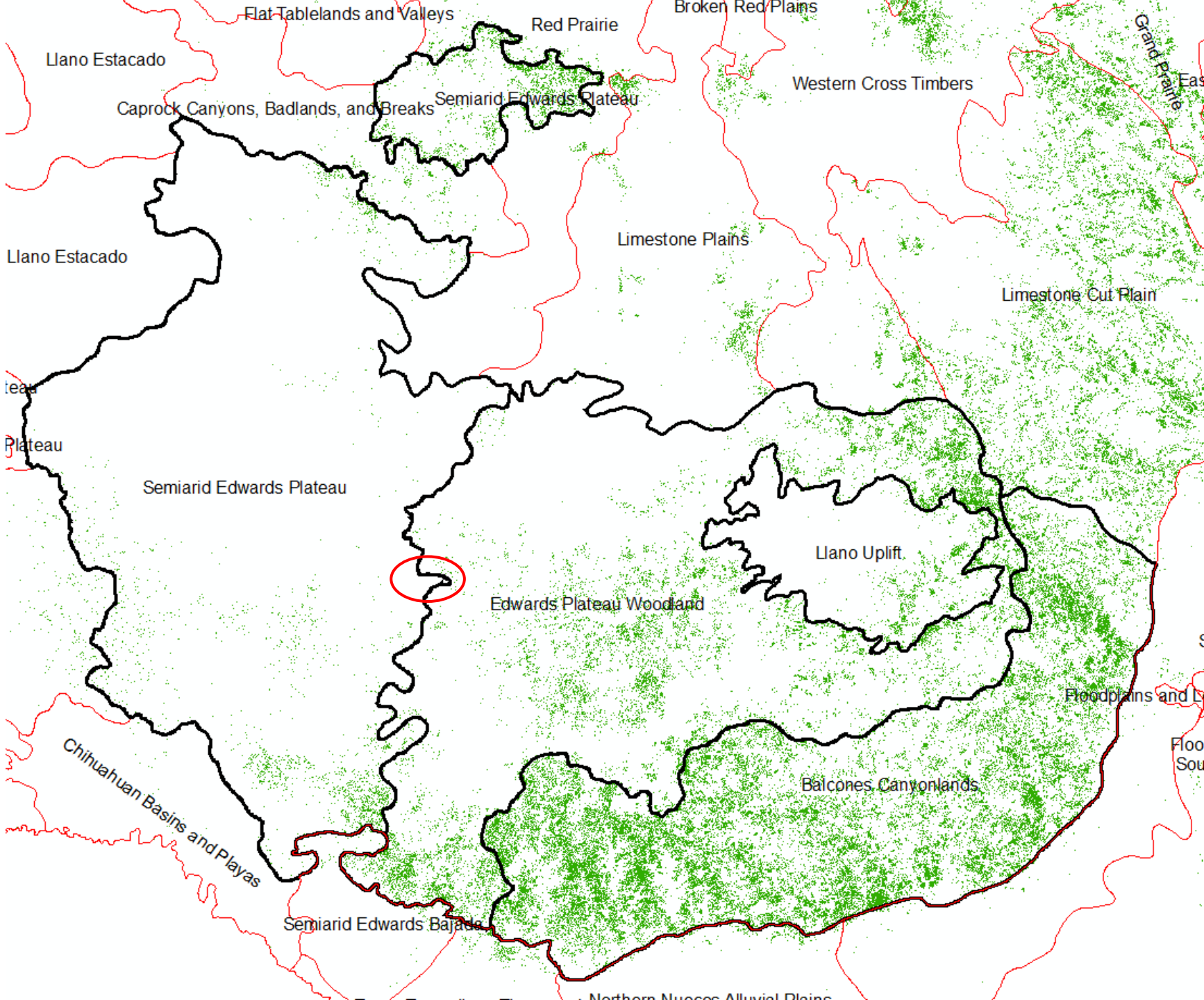
Semi-arid Edwards Plateau is dry

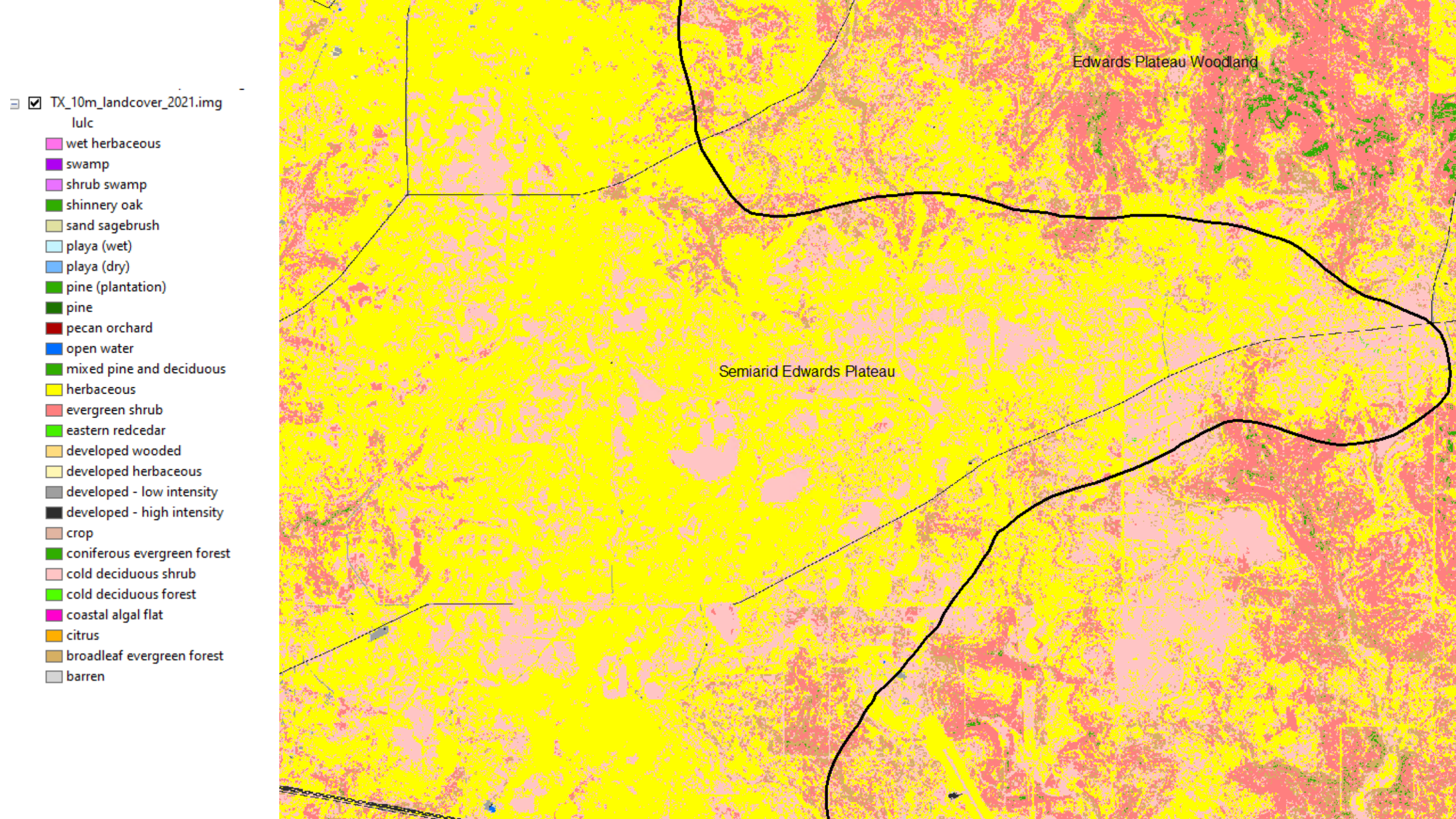
Llano Uplift has different surface geology than other regions

Limestone Cut Plain is similar to the Edwards Plateau



Ashe's Juniper Woodland (green) is in wetter areas, and/or on rougher terrain




TX_10m_landcover_2021.img
lulc
wet herbaceous
swamp
shrub swamp
shinnery oak
sand sagebrush
playa (wet)
playa (dry)
pine (plantation)
pine
pecan orchard
open water
mixed pine and deciduous
herbaceous
evergreen shrub
eastern redcedar
developed wooded
developed herbaceous
developed - low intensity
developed - high intensity
crop
coniferous evergreen forest
cold deciduous shrub
cold deciduous forest
coastal algal flat
citrus
broadleaf evergreen forest
barren
Edwards Plateau Woodland
Semiarid Edwards Plateau

Ashe’s Juniper is only moderately drought-tolerant

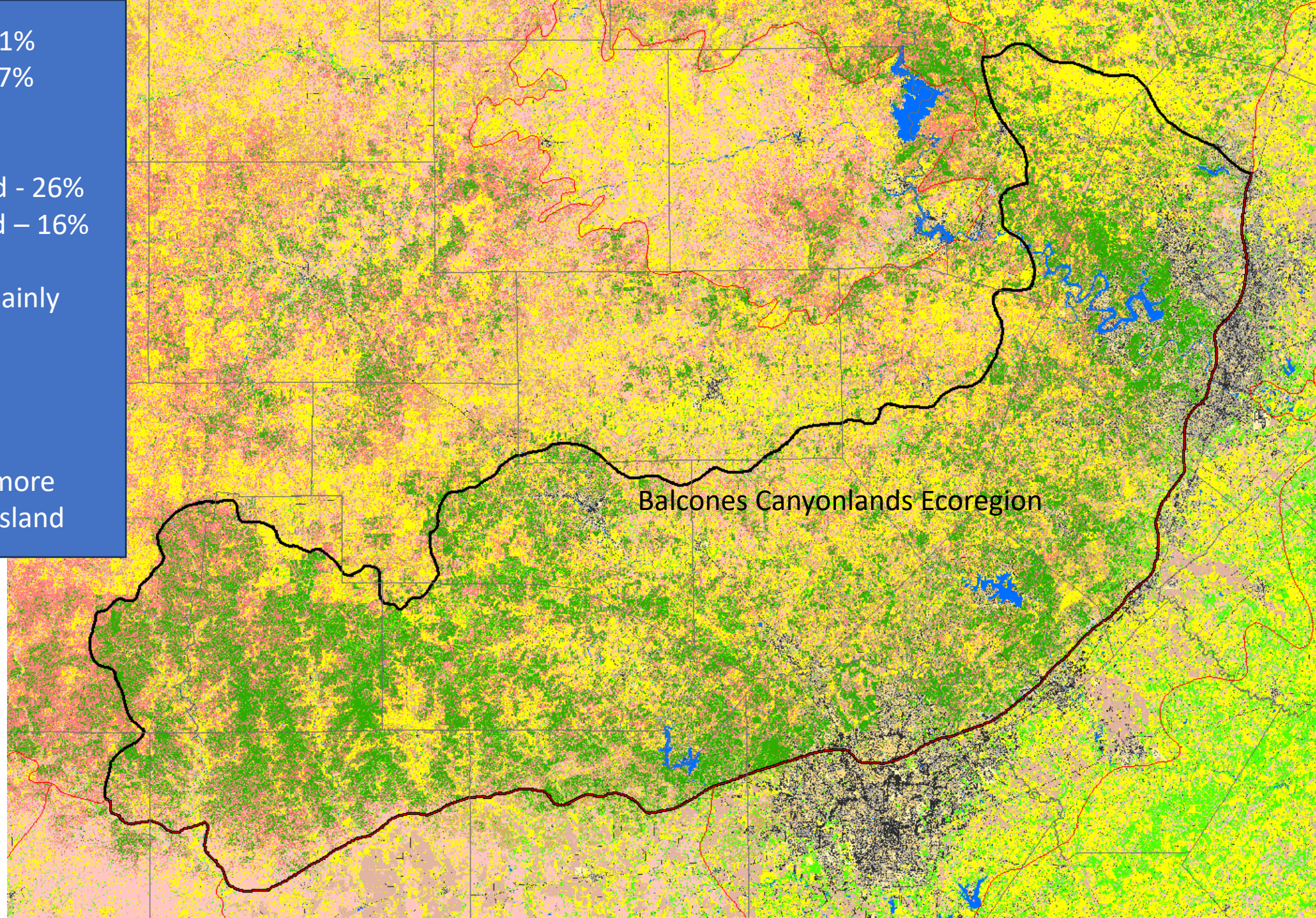
Woodland (all types) – 41%
Shrubland (all types) – 27%
Grassland cover - 21%

Ashe's Juniper Woodland - 26%
Ashe's Juniper Shrubland – 16%

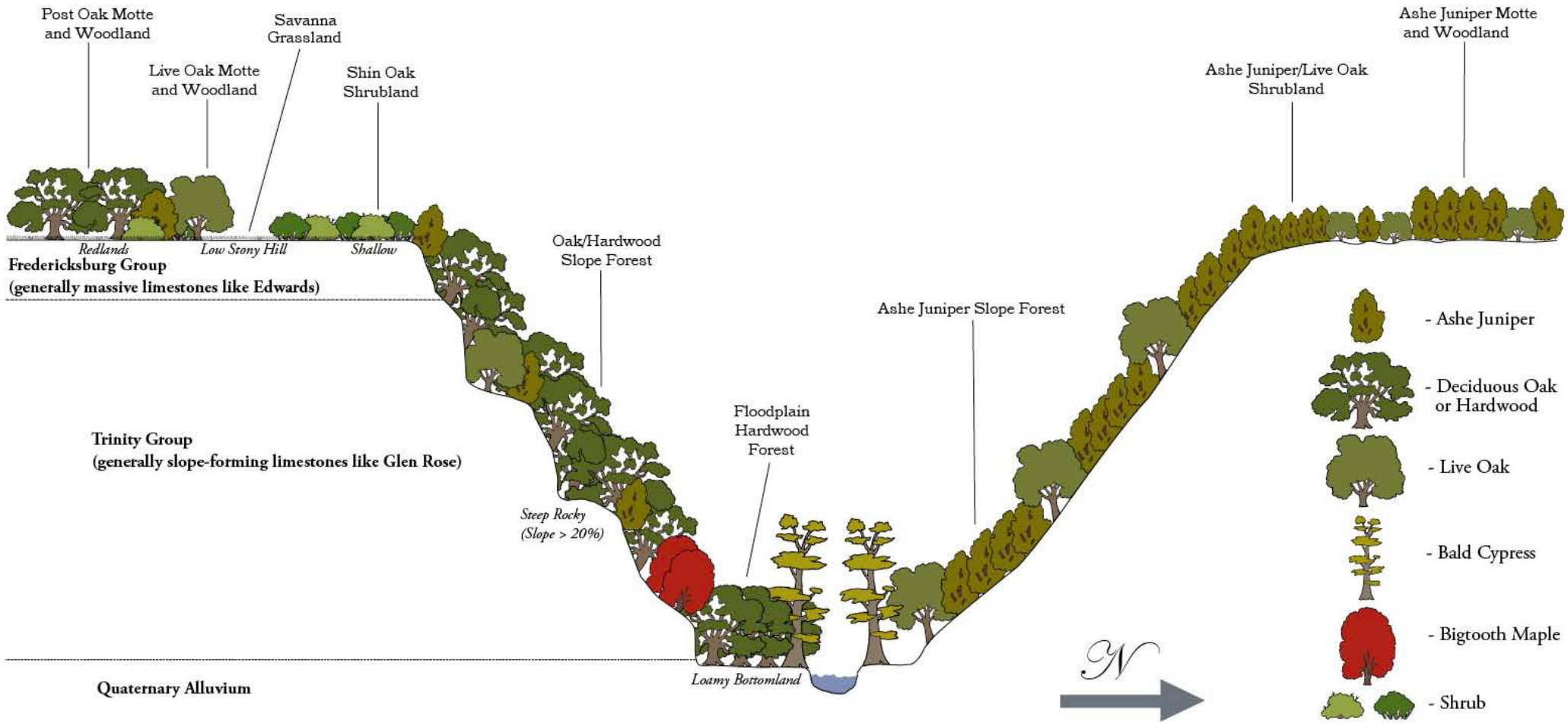
Deciduous Shrubland (mainly shin oak) – 11%

Urban cover – 9%

Slopes >20 degrees: 6X more forest; half as much grassland



Conceptual Balcones Canyonlands Landscape – TPWD Landscape Ecology Program, 2014



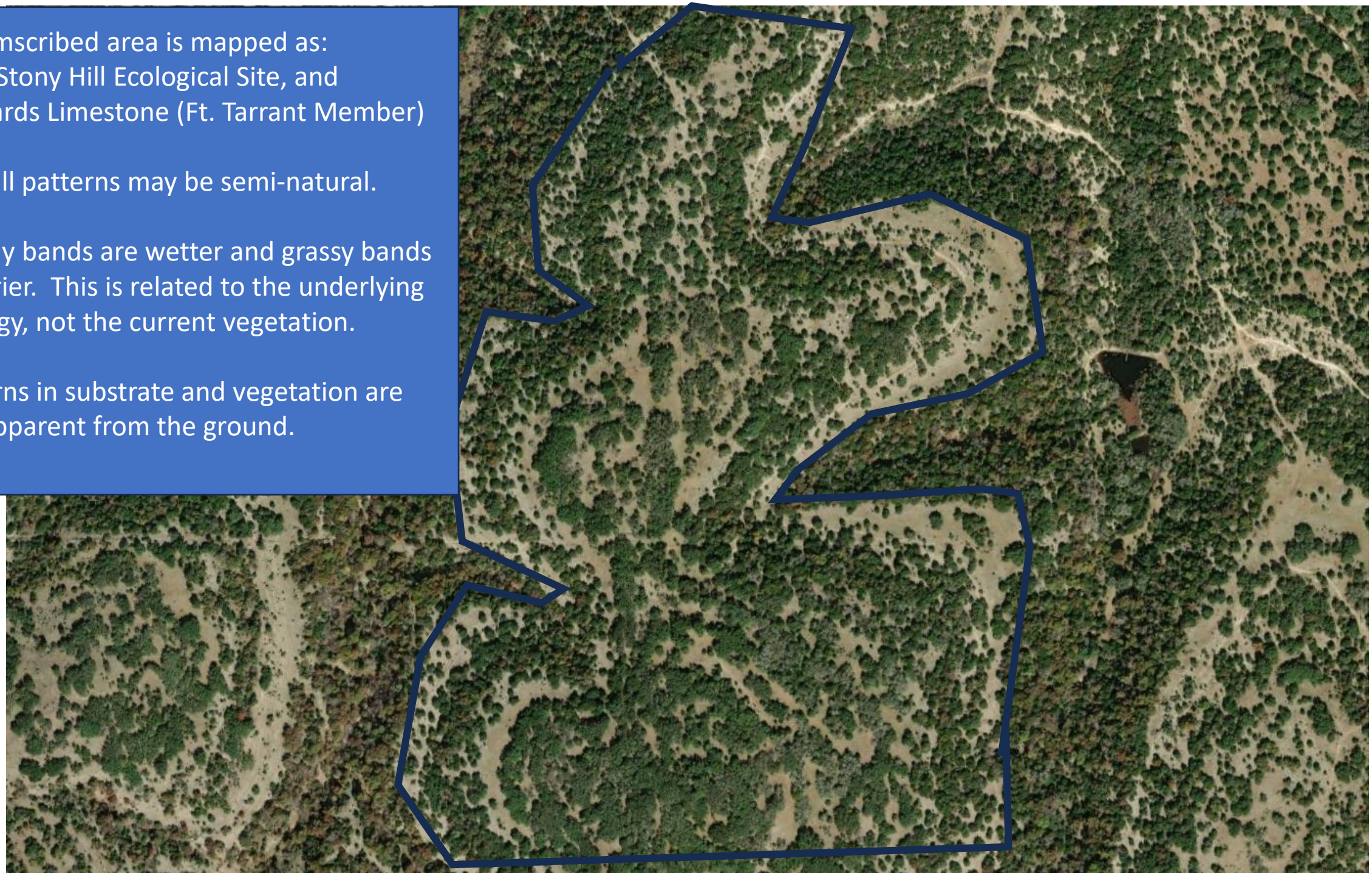
Local landform, geology, and soils influence current vegetation (in addition to management)

Circumscribed area is mapped as:
-Low Stony Hill Ecological Site, and
-Edwards Limestone (Ft. Tarrant Member)

Overall patterns may be semi-natural.

Woody bands are wetter and grassy bands are drier. This is related to the underlying geology, not the current vegetation.

Patterns in substrate and vegetation are not apparent from the ground.

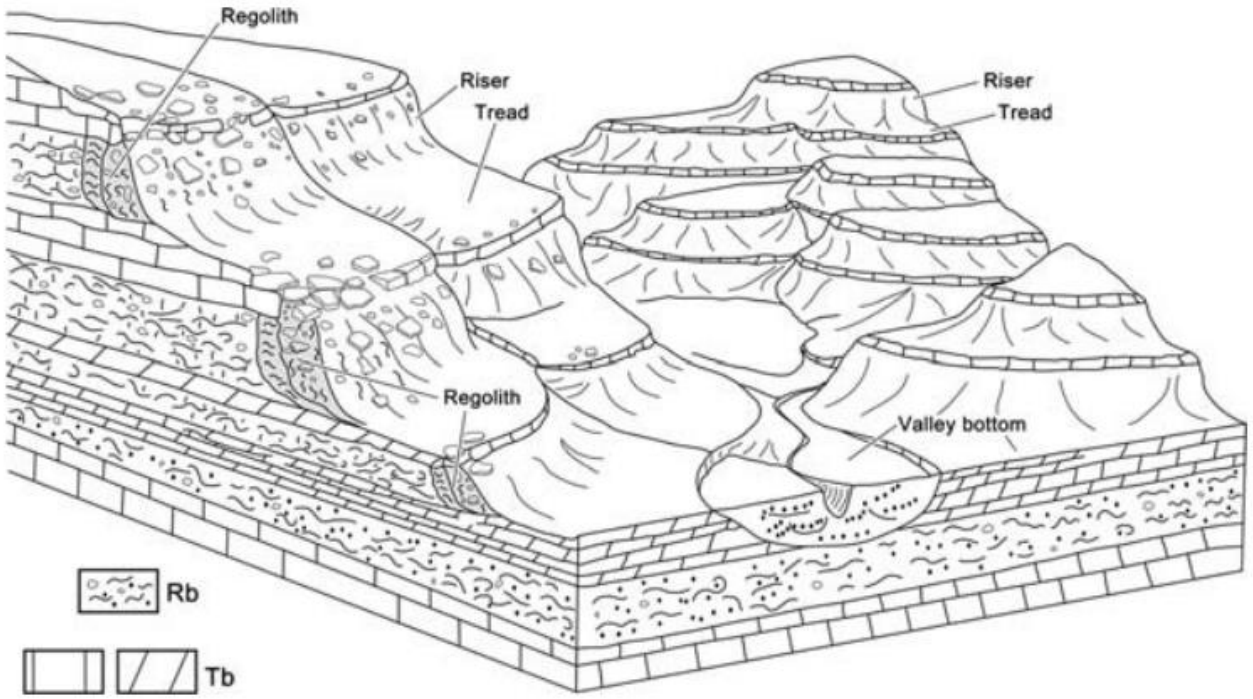


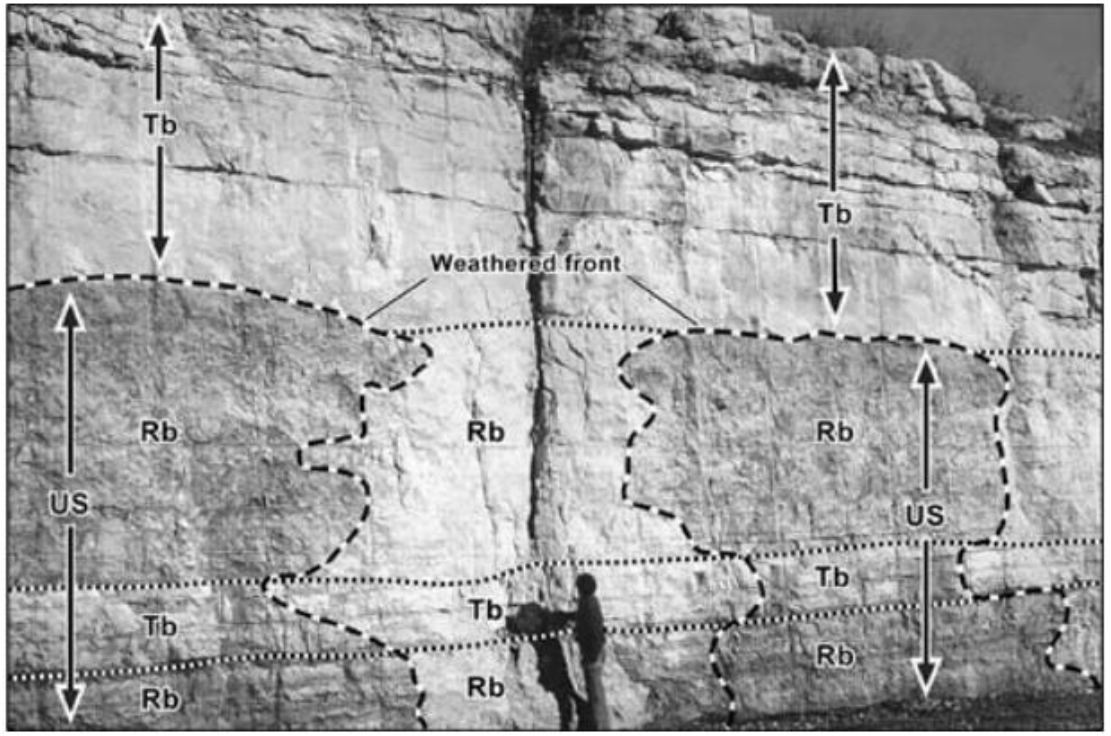
Environ Geol
DOI 10.1007/s00254-007-1011-4

ORIGINAL ARTICLE

Bedrock, soils, and hillslope hydrology in the Central Texas Hill Country, USA: implications on environmental management in a carbonate-rock terrain

C. M. Woodruff Jr · L. P. Wilding





Mapped Type Name	Field Samples	Area (Ha)
Edwards Plateau: Savanna Grassland	389	1,877,860
Edwards Plateau: Ashe Juniper-Live Oak Shrubland	284	1,268,470
Edwards Plateau: Live Oak Motte and Woodland	165	760,740
Edwards Plateau: Juniper Semi-arid Shrubland	105	697,806
Edwards Plateau: Semi-arid Grassland	149	647,475
Edwards Plateau: Ashe Juniper Motte and Woodland	103	458,227
Edwards Plateau: Deciduous Semi-arid Shrubland	95	456,854
Edwards Plateau: Oak - Hardwood Motte and Woodland	71	419,007
Edwards Plateau: Deciduous Oak - Evergreen Motte and Woodland	52	290,955
Edwards Plateau: Shin Oak Shrubland	64	249,997
Edwards Plateau: Floodplain Herbaceous Vegetation	45	183,931
Edwards Plateau: Juniper Semi-arid Slope Shrubland	36	163,546
Edwards Plateau: Floodplain Deciduous Shrubland	68	151,611
Edwards Plateau: Ashe Juniper Slope Forest	16	150,359
Edwards Plateau: Ashe Juniper-Live Oak Slope Shrubland	48	145,423
Edwards Plateau: Riparian Ashe Juniper Shrubland	52	142,932
Edwards Plateau: Floodplain Hardwood Forest	37	123,745
Edwards Plateau: Riparian Deciduous Shrubland	29	113,631
Edwards Plateau: Oak - Ashe Juniper Slope Forest	22	104,615

From TPWD Landscape Ecology Program

East to West and North to South variation in the vegetation exists

Mapped Type Name	Mapped Type Brief Description	Field Samples	Area (Ha)
Edwards Plateau: Savanna Grassland	Grassland condition varies for this mapped type, but many areas contain non-native King Ranch bluestem as an important species, and Bermudagrass is also frequent. Common native grasses include little bluestem, sideoats grama, silver bluestem, Texas wintergrass, purple three-awn, and common curlymesquite. Trees and shrubs are usually present, and may include plateau live oak, Ashe juniper, mesquite, agarito, and/or cedar elm.	389	1,877,860
Edwards Plateau: Ashe Juniper-Live Oak Shrubland	Ashe juniper and plateau live oak are the most frequent dominants of this evergreen shrubland. Plateau live oak and/or Ashe juniper may form a sparse canopy and Vasey oak (west), white shin oak, Mohr's shin oak (west), agarito, Texas persimmon, Texas mountain-laurel, mesquite, Lindheimer's pricklypear may be common in the understory.	284	1,268,470
Edwards Plateau: Live Oak Motte and Woodland	Plateau live oak alone or with Ashe juniper usually dominates the overstory of this type. Deciduous trees such as cedar elm, sugar hackberry, white shin (or Vasey) oak, Lacey oak, and Texas oak may be components. Shrubs such as mesquite, Texas persimmon, and agarito are common.	165	760,740
Edwards Plateau: Juniper Semi-arid Shrubland	Redberry juniper and Ashe juniper may both be present in this type, together with species such as plateau live oak, mesquite, Texas persimmon, Lindheimer pricklypear, Texas sotol, and agarito. Important grasses may include sideoats grama, purple threeawn, curlymesquite, slim tridens, hairy tridens, and Texas wintergrass.	105	697,806

Edwards Plateau Dry-Mesic Slope Forest and Woodland

Download PDF
Nature Serve ID: CES303.656

Geology

Found on limestone (primarily Creatceous or Pennsylvanian) slopes within the Edwards Plateau and adjacent ecoregions, including the Carbonate Cross Timbers in the Palo Pinto County area and the Callahan Divide. Cuestas of cretaceous chalk in the Blackland Prairie and calcareous slopes of the Crosstimbers may also be occupied by this system.

Landform

Slopes generally greater than 20 percent.

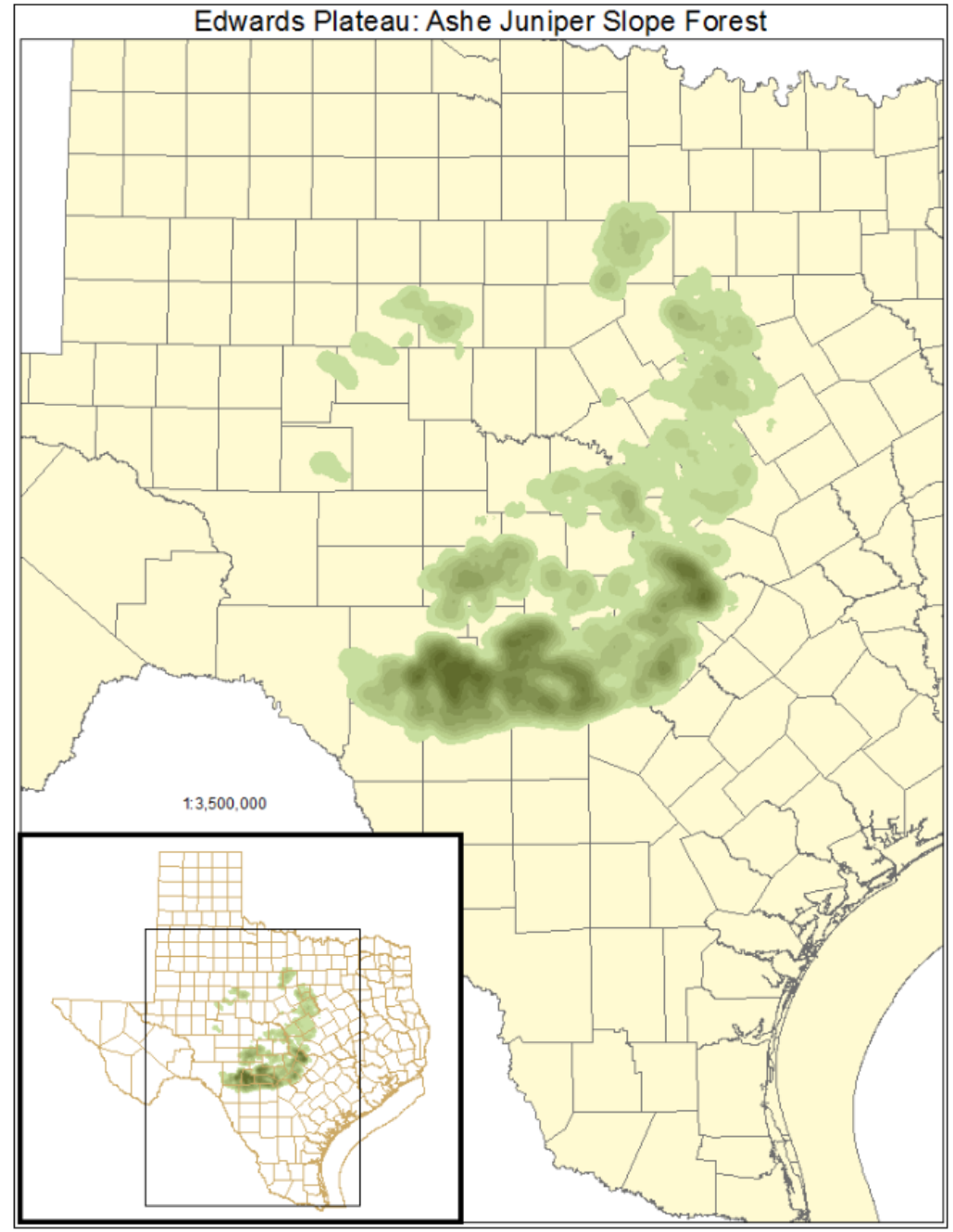
Soils

Stones and boulders are conspicuous on the soil surface. Soils are generally dark clay to clay loam and shallow. Steep Rocky and Steep Adobe Ecological Sites may be associated with this system.

Parent Description

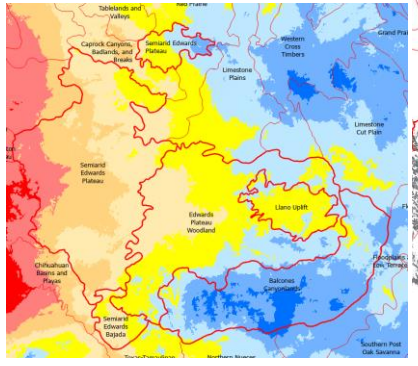
This system occurs on dry to mesic, middle slopes of the rolling uplands and escarpments of the Edwards Plateau and similar sites. The canopy is typically dominated or co- dominated by deciduous trees, including *Quercus buckleyi* (Texas oak), *Quercus laceyi* (Lacey oak), *Quercus sinuata var. breviloba* (white shin oak), *Fraxinus texensis* (Texas ash), *Ulmus crassifolia* (cedar elm), *Prunus serotina ssp. eximia* (escarpment black cherry), *Juglans major* (Arizona walnut), and/or *Celtis laevigata var. reticulata* (netleaf hackberry). *Quercus fusiformis* (plateau live oak) and *Juniperus ashei* (Ashe juniper) are often present and are sometimes co- dominant with deciduous species of this system. Canopy closure is variable, and this system can be expressed as forests or woodlands. The shrub layer may be well-represented, especially where the overstory canopy is discontinuous. Species such as *Aesculus pavia var. flavescens* (red buckeye), *Cercis canadensis var. texensis* (Texas redbud), Forestiera pubescens (elbowbush), *Ungnadia speciosa* (Mexican buckeye), *Ceanothus herbaceus* (Jersey tea), *Frangula caroliniana* (Carolina buckthorn), *Sophora secundiflora* (Texas mountain-laurel), *Viburnum rufidulum* (rusty blackhaw), *Rhus spp.* (sumac), *Vitis spp.* (grape), and Garrya ovata (silktassel) may be present in the shrub layer. With the large amount of exposed rock, frequent accumulation of leaf litter, and significant canopy closure, herbaceous cover is generally sparse, with *Carex planostachys* (cedar sedge) often present. Woodland forbs such as *Tinantia anomala* (widowstears), *Chaptalia texana* (silver-puff), *Nemophila phacelioides* (baby blue-eyes), *Salvia roemeriana* (cedar sage), *Lespedeza texana* (Texas lespedeza), and various ferns may also be present, if patchy. Grasses such as *Schizachyrium scoparium* (little bluestem) and *Bouteloua spp.* (gramas) may occur, typically scattered and patchy.

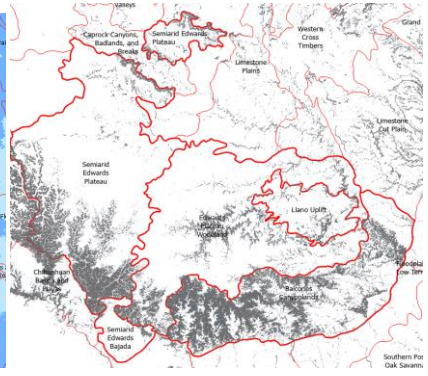
Distribution Map

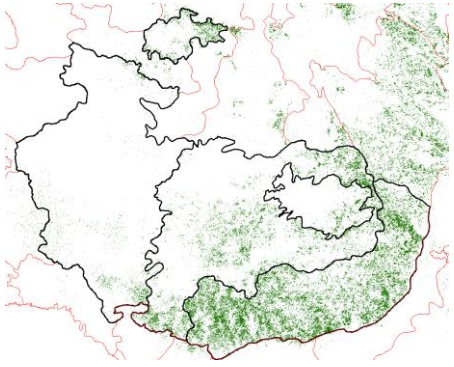


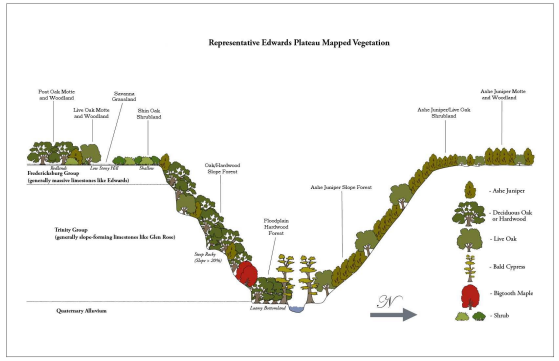
Vegetation Pattern Summary

- The Edwards Plateau is drier, with fewer woodlands and more grassland and shrubland to the west
- The Balcones Canyonlands is the wettest sub-division of the Edwards Plateau, is rugged, and therefore is the most wooded ecoregion
- Locally, landform, geology, and soils influence vegetation patterns, in addition to management
- Fine-resolution variation in geology and soils are often not mapped
- Species composition varies from east to west, and north to south
- *"All generalizations are dangerous, even this one."* – Alexander Dumas









Balcones Canyonlands Pre-European Vegetation Patterns

Unknowable, in a quantitative sense; patchy, diverse and easy to over-generalize

Most steep slopes were woodland or forest, and were protected from fire for decades at least, possibly centuries

Uplands were likely a mosaic of woodland, shrubland, and grassland, but probably more wooded than grassy, same as in the modern landscape

Major woody components:

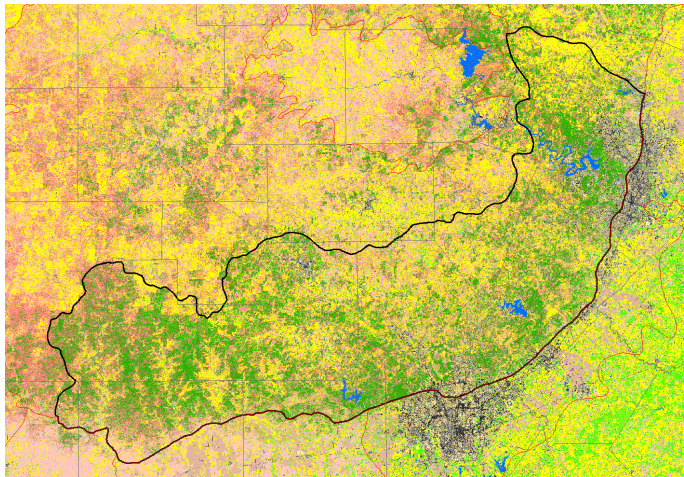
- -Ashe's juniper
- -Texas live oak
- -Texas red oak
- -Shin oak

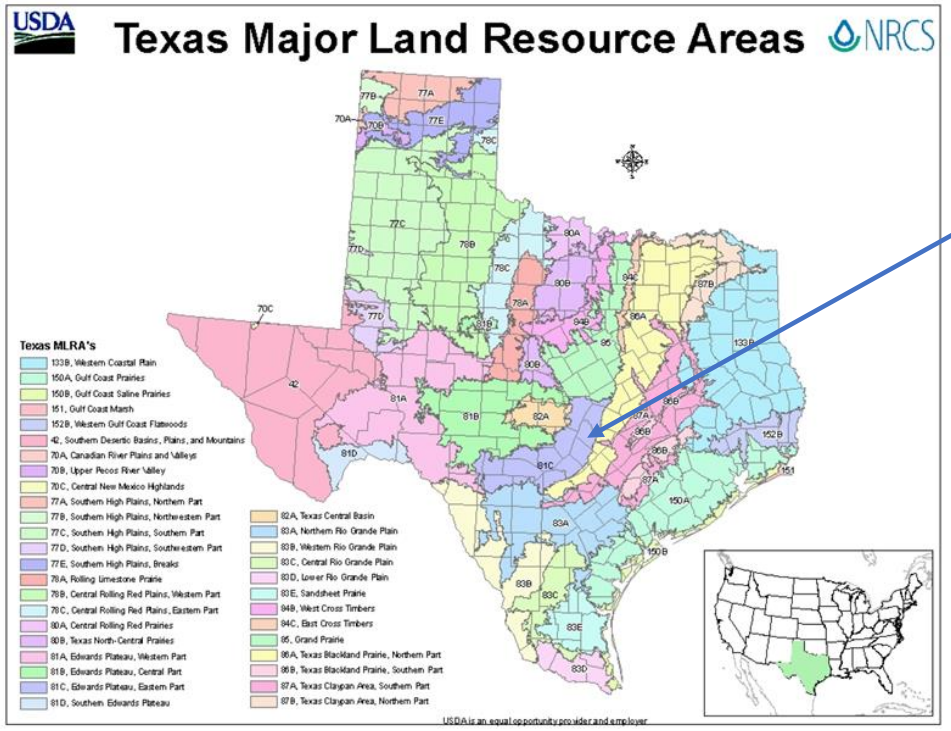
Diamond and True, 2008. Distribution of *Juniperus* woodlands in central Texas in relation to general abiotic site type.

"Overall changes in land cover have not been dramatic since European settlement, despite long-term attempts to reduce Ashe's juniper cover …. Management regimes related to abiotic site types and current conditions should be adopted."

The most significant invasive species of grasslands is Yellow (King Ranch) Bluestem; Chinaberry is most widespread invasive species of woodlands, and other species may spread from urban areas

Urban (9%) is largest non-natural landcover class and has about doubled since 2008; this is quite "dramatic"





Twelve Ecological Sites of Edwards Plateau, Eastern Part Major Land Resource Area

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"# date: 2023-03-06"
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081C    R081CY355TX     R081CY355TX     "Adobe 29-35 PZ"
081C    R081CY356TX     R081CY356TX     "Blackland 29-35 PZ"
081C    R081CY357TX     R081CY357TX     "Clay Loam 29-35 PZ"
081C    R081CY358TX     R081CY358TX     "Deep Redland 29-35 PZ"
081C    R081CY359TX     R081CY359TX     "Gravelly Redland 29-35 PZ"
081C    R081CY360TX     R081CY360TX     "Low Stony Hill 29-35 PZ"
081C    R081CY361TX     R081CY361TX     "Redland 29-35 PZ"
081C    R081CY362TX     R081CY362TX     "Steep Adobe 29-35 PZ"
081C    R081CY363TX     R081CY363TX     "Steep Rocky 29-35 PZ"
081C    R081CY561TX     R081CY561TX     "Loamy Bottomland 29-35 PZ"
081C    R081CY574TX     R081CY574TX     "Shallow 29-35 PZ"
081C    R081CY699TX     R081CY699TX     "Clayey Bottomland 29-35"" PZ"
```

1 December 2010

Ecological Sites: Their History, Status, and Future

Joel R. Brown

Author Affiliations +

Rangelands, 32(6):5-8 (2010). https://doi.org/10.2111/RANGELANDS-D-10-00089.1

State and Transition Models: concept is that transitions within a box are easy, but between boxes hard

Over-generalization: conceptual description cannot capture spatial variation on the ground

Herbaceous component is over-emphasized in this region

Soils can be mis-mapped

Low Stony Hill 29-35" PZ
R081CY360TX

1. Savannah State

1.1 Grassland Savannah Community
Tall-midgrasses 10-20% canopy oaks
Reference Plant Community

1.2 Savannah shrubland Community
Midgrasses with 10-20% canopy oaks, juniper < 6' tall

1.1A

1.2A

T1A

R2A

T1B

2. Oak Juniper state

2.1 Oak/juniper grassland community
Oaks 20–25% canopy, Juniper 10-20% canopy, 6-15' height

2.2 Oak/juniper/mesquite woodland community
Juniper >25% canopy, >20' height.

2.1A

T2A

T2B

3. Open Grassland State

3.1 Open Grassland Community
Herbaceous plants with woody plant reduction, introduced species,

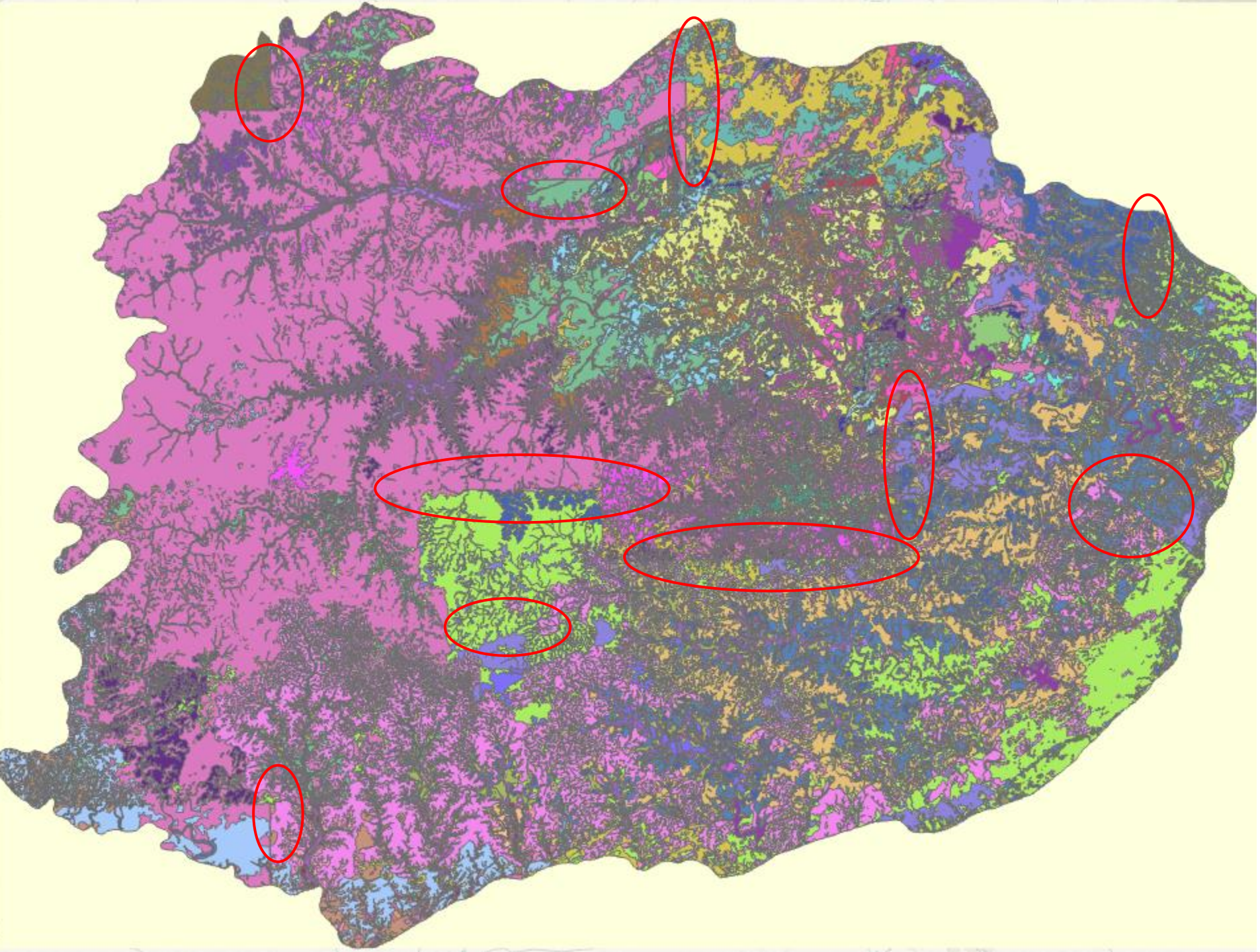
3.2 Woodland Community
Invasion of woody and herbaceous species

3.1A

3.2A

4. Hydro mulched State

4.1 Hydro mulched community
Savannah with limited herbaceous plants



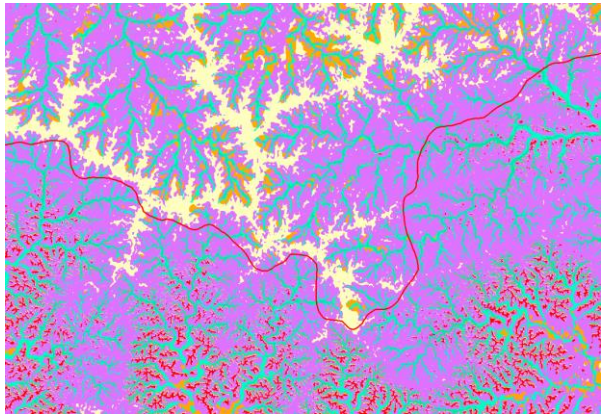
Soils by ECOCLASSID
(Ecological Site Type)

Soil mapping is inconsistent and imprecise; mis-matches at county lines are common and impossible to correct

Other geophysical datasets can be used to help map vegetation and guide management

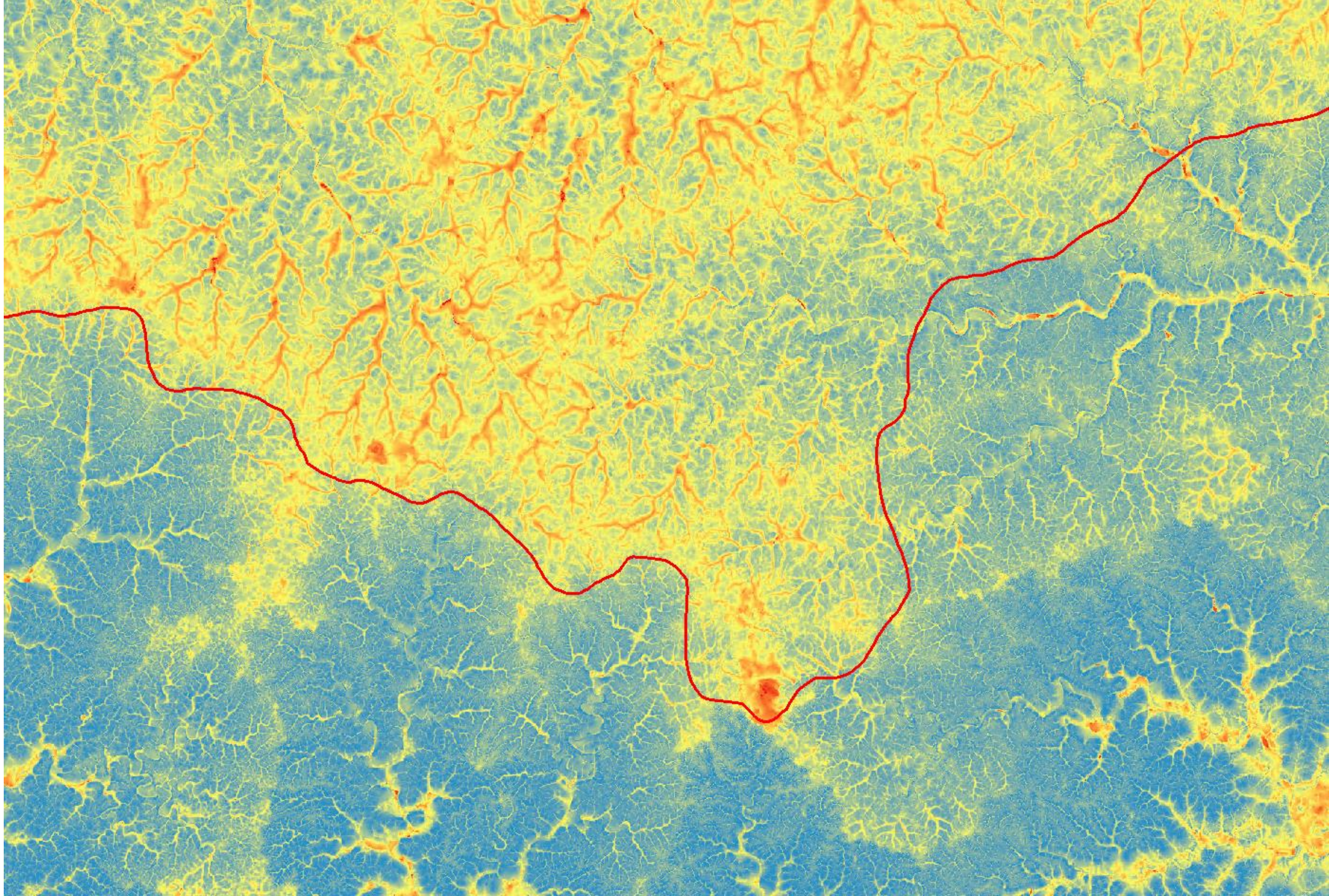
Helpful New Geophysical Setting Information

- Categorical Datasets
  - Hammond-style landforms (coarser than soils maps)
  - Surface geology (coarse, but appealing)
  - Sayre-style ecosystems maps (coarser than soils but appealing)
  - ALOS (combines heat load -slope/exposure- and land position into 15 classes)
  - Geomorphons (pattern recognition/viewshed-based, output 10 class landform model)
- Continuous Datasets
  - Percent slope (calculated from difference between high and low within a neighborhood)
  - Roughness (difference between high and low within a neighborhood)
  - Solar radiation (solrad; integrates slope, exposure (N/S), and shading)
  - Topographic wetness indices (TWI, TMI, WILT)
  - Flow accumulation
  - SMAP (from Remote Sensing and hydrologic modeling)
  - POLARIS (soil variables modeled from terrain using gSSURGO training)



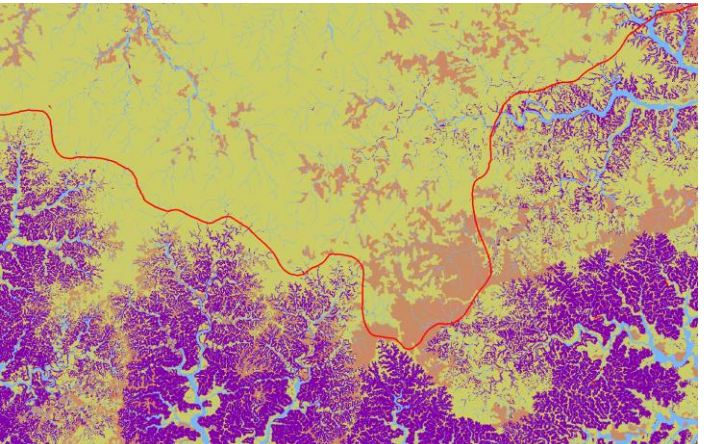
Topographic Wetness Index

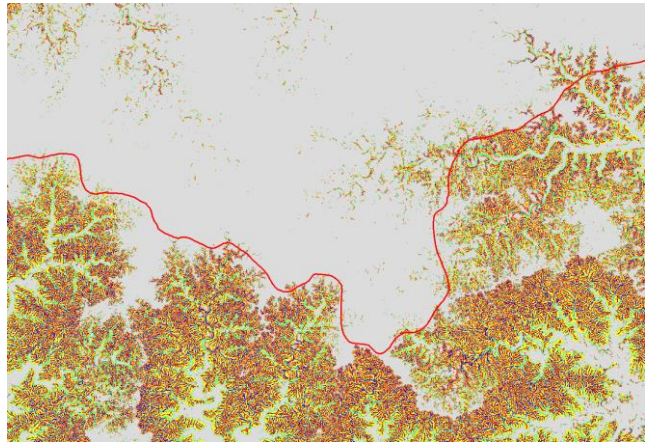
Red is wetter

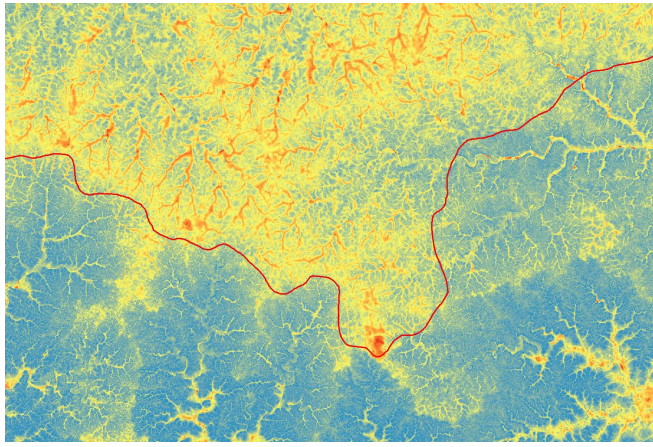


Use of New Geophysical Datasets

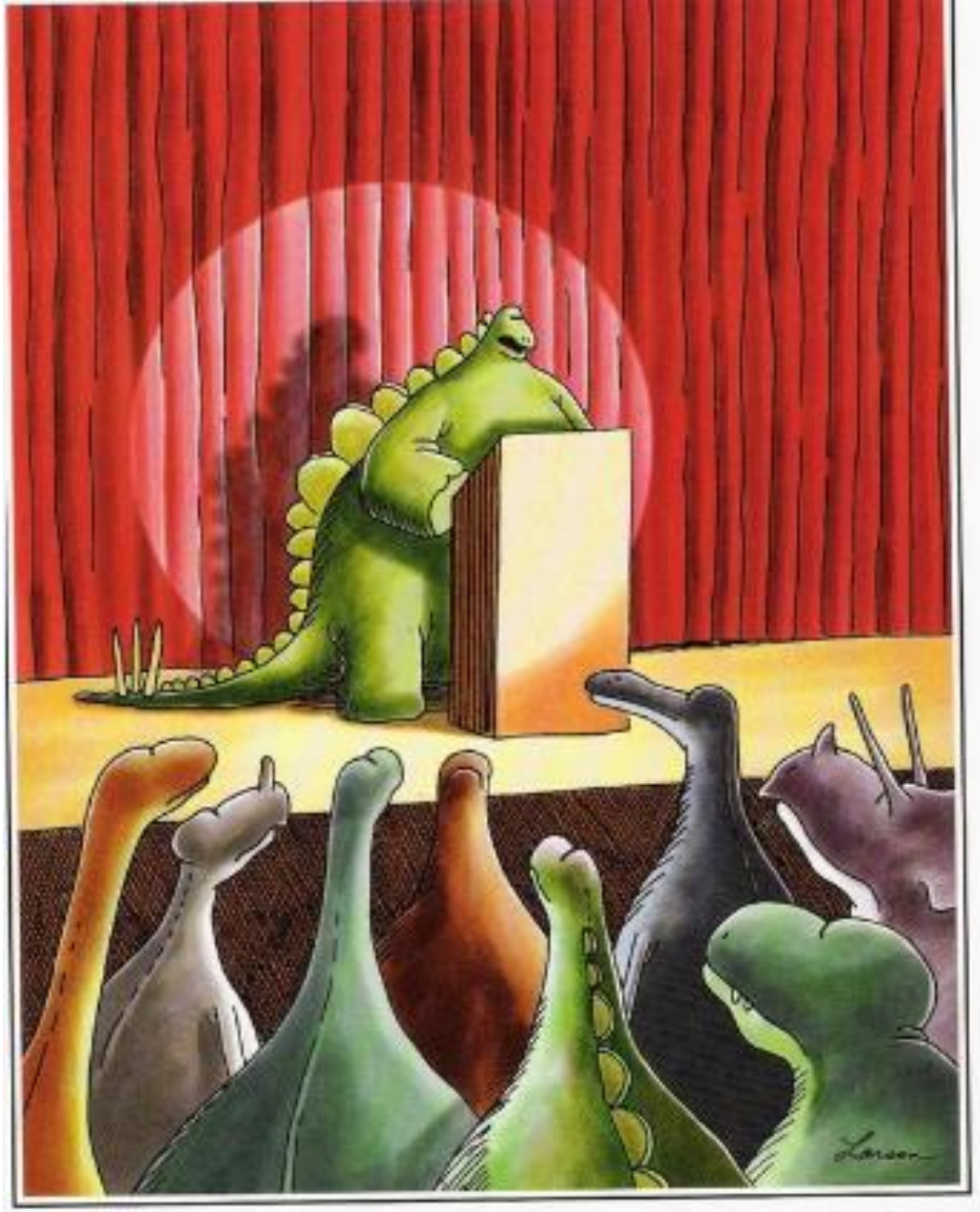
- Many exist and have been used for mapping and management
- Can be fine-resolution and accurate, with appealing visual presentation
- Use can be challenging
  - Accessibility
  - Interpretation of ecological meaning
- Application for mapping and management on the Edwards Plateau is doable







“The picture’s pretty bleak gentlemen … The world’s climates are changing, the mammals are taking over, and we all have a brain about the size of a walnut.”



"The picture's pretty bleak, gentlemen. … The world's climates are changing, the mammals are taking over, and we all have a brain about the size of a walnut."

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