A CONDITION INDEX FOR GRASSLAND/PRAIRIE/SAVANNA IN THE GULF COASTAL PLAIN, MISSISSIPPI ALLUVIAL VALLEY, AND OZARK HIGHLANDS

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Introduction

Grasslands are a major habitat type of global conservation concern. In the southeastern United States, combined effects of soil, grazing, windthrow, and fire (both lightning struck and anthropogenic) have given rise to ecologically significant grassland/prairie/savanna patches in a region with enough rainfall to support forests. Most of these landscapes have been lost due to conversion to other land uses and landscape-scale interruptions in the historical disturbance pattern.

The Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative (GCPO LCC) is developing a blueprint for landscape conservation design for nine broadly defined habitat (BDH) systems, including grasslands. The Grassland Condition Index presented here is part of a Rapid Ecological Assessment process intended to answer the questions *how much grassland do we have? Where is it? What are the conditions in the patches?*

Method

A region-wide ecological systems map

A review of national-scale spatial data layers of ecological systems, land use, and land cover (NLCD, NatureServe, GAP, and LANDFIRE) at four known prairie remnant sites in Mississippi reveals that misclassification of natural grasslands as pasture/hay or cultivated crops is common in the data. Of the four products, LANDFIREevt is more likely than the others to misclassify prairie as pasture/hay, which is a grassland type, rather than cultivated crops, which is not (Figure 1). Therefore, LANDFIREevt was selected to drive the wall-to-wall regional assessment. Forty-seven grassland ecological system classes were selected, from which thirty were considered as meeting the more restrictive classification of prairie.

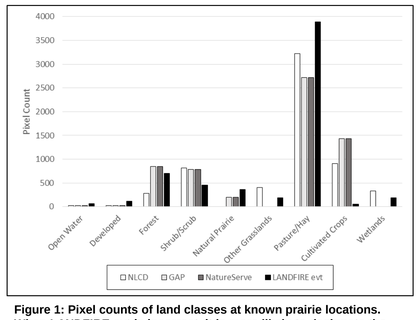

Figure 1: Pixel counts of land classes at known prairie locations. When LANDFIRE evt is incorrect, it is more likely to designate the pixel as pasture/hay, a grassland type, than is GAP, NatureServe, or NLCD.

Harrell Prairie Hill, Bienville National Forest, Mississippi. Photo by Toby Gray

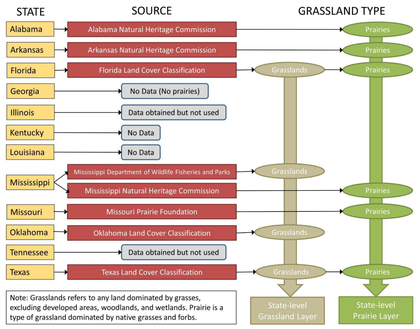

Figure 2: Grassland and prairie geospatial data layers obtained from state-level agencies and organizations.

State-level contributions to the assessment

Polygons of observed prairie patches from state-level sources were added to the set of selected classes from the LANDFIRE evt data layer in order to enhance the map of grassland/prairie/savanna in the GCPO. We used publicly available, high resolution land cover classification maps for the states of Oklahoma, Texas, and Florida, and contributions from researchers, non-governmental agencies, and state agencies for Alabama, Arkansas, Mississippi, and Missouri. We were unable to obtain any data from Georgia, Illinois, Kentucky, Louisiana, or Tennessee (Figure 2).

We combined grassland spatial data layers obtained at the state level with the layer of selected LANDFIRE evt classes to create a **Grassland Mask** describing the presence of grasslands in the GCPO geography.

Our Ecological Assessments and Conservation Blueprint maps are continually being revised. If your organization or agency has data that should be included in this assessment please let us know!

What is the difference between grassland and prairie?

Most scientists agree that "grassland" can refer to any landscape dominated by grasses (members of the family Poaceae), and featuring a mixture of non-graminoid herbaceous species called forbs, with few trees or shrubs (Anderson 2006, Noss 2013, Deselm and Murdock 1993). Within that broad category, however, vegetative classes have been described in confusing and inconsistent ways: prairie, barren, and glade have been used by different authors to refer to the same thing, and what some call a glade, others call an outcrop (Noss 2013).

For this project, grassland refers to any area dominated by grass, including pasture/hay. This definition allows for the presence of exotic species. Prairie refers to areas dominated by native grasses and forbs, with few or no exotic species present.

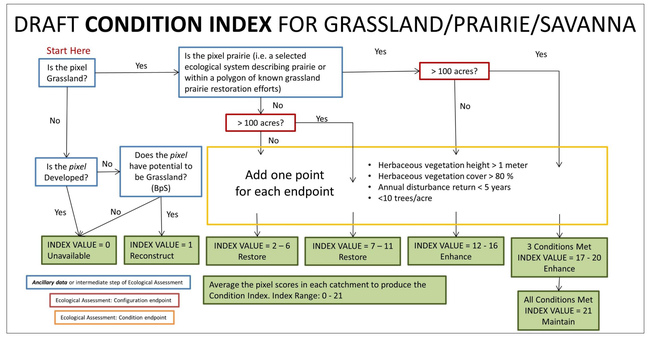

Figure 4: A decision tree was applied to each pixel in the geography of the GCPO to generate the Condition Index.

Condition Endpoints

The Draft Integrated Science Agenda for the GCPO LCC proposes a set of measurable condition endpoints that collectively describe the desired ecological state for grassland/prairie/savanna. These are:

- **Patch size > 100 acres:** Obtained by converting the Grassland Mask from raster to polygon data layer and measuring polygon areas.
- **Vegetation height 4-6':** Obtained by selecting herbaceous classes > one meter in height from the LANDFIRE existing vegetation height (evh) data layer
- **Bare ground > 5% but < 20% and shrub cover <20%:** Obtained by selecting herbarceous classes > 80% and shrub classes < 20% form the LANDFIRE existing vegetation cover (evc) data layer
- **Tree density < 10/acre:** Obtained by selecting pixels from an unpublished data layer shared with us by USFS which describes trees per acre based on Forest Inventory and Analysis (FIA) and satellite imagery inputs.
- **Five-year return on disturbance, with 20% of all grasslands disturbed annually:** Obtained by selecting appropriate classes from the CONUS Vegetation Disturbance data product from LANDFIRE.

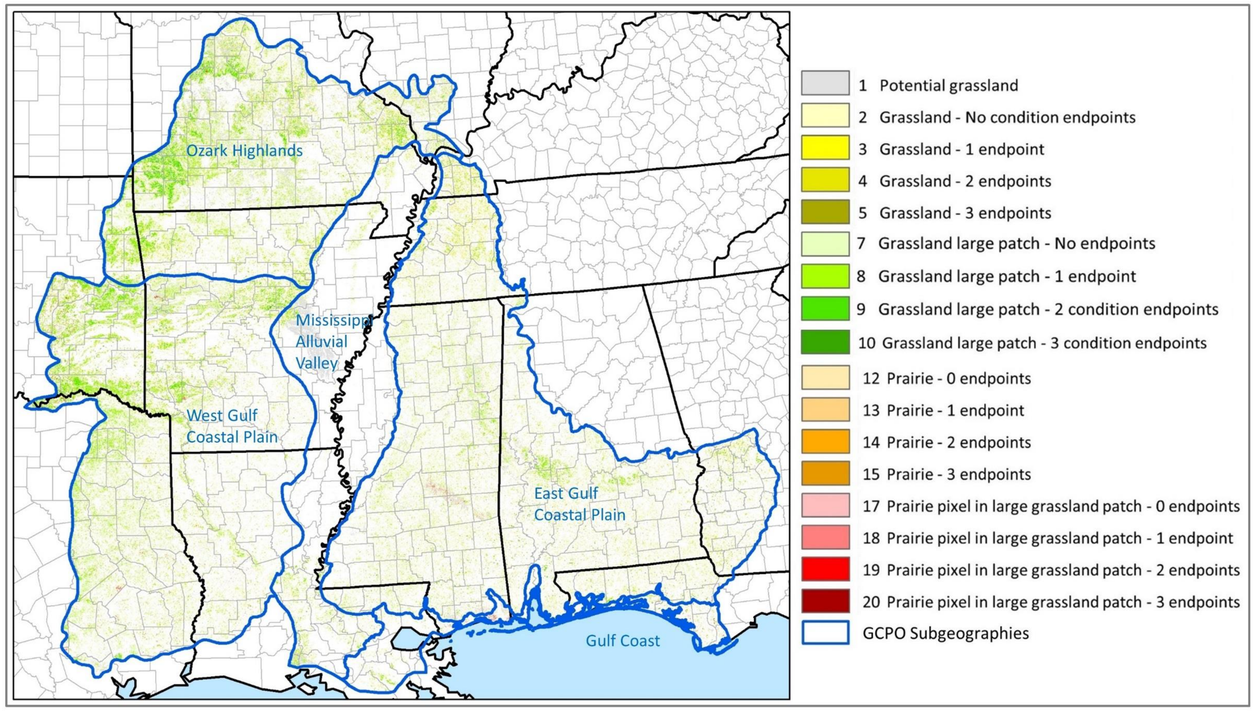

Figure 5: Grassland pixels are scattered widely throughout the Gulf Coastal Plains and Ozark Highlands. Prairie pixels characterized by multiple desired condition endpoints are very rare.

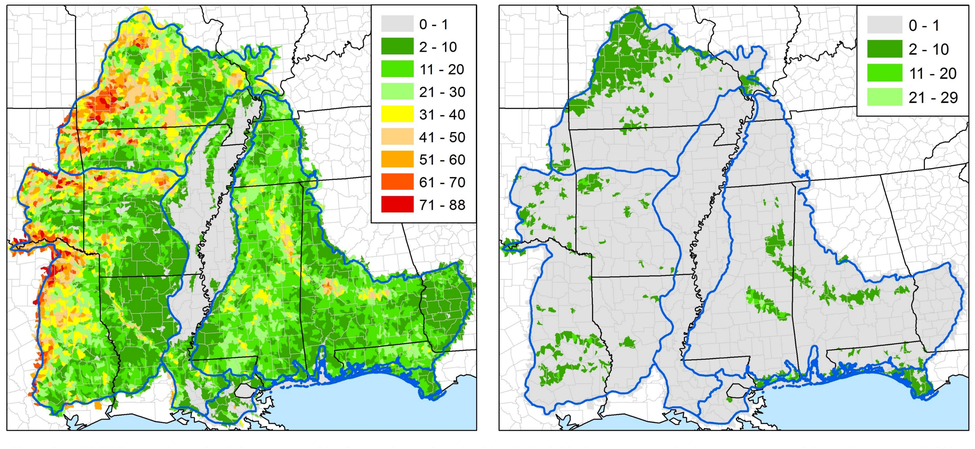

Figure 3: LANDFIRE evt and state-level data were combined to produce a Grassland Mask. Mask Pixels were summarized as a percentage of the total cover per HUC12 watershed for all grasslands (left) and for those meeting the more restrictive designation of prairie (right).

Discussion

Grassland is a dynamic, disturbance-dependent system in which conditions change more rapidly than in forests. Detection of grasslands in good condition in large landscapes is difficult: site level observations are only good for about five years in a landscape context of productive soils and abundant rainfall. Currently, remote sensing-based mapping procedures do a poor job of distinguishing natural prairie from other herbaceous land cover and ecological system classes. A useful region-wide inventory of this important vegetation type will require ongoing cooperative efforts of multiple agencies and organizations.

Purple coneflower at Harrell Prairie Hill, Bienville National Forest, Mississippi. Photo by Toby Gray

Limitations:

This is a draft ecological assessment, and is by no means the final word on the location and condition of every grassland in the Gulf Coastal Plains region. Data layers from LANDFIRE and USFS used to describe site-level conditions such as vegetation height and percent cover were generally designed to address forest conditions, not grasslands. Like other large landscape spatial data products, these maps are intended to guide regional planning decisions and are not necessarily applicable at local neighborhood scales.

Results

Through a combination of LANDFIREevt classes and state-level spatial data inputs, we identified about 32 million acres of grassland, about a million acres of which may be considered natural prairie (Figure 3, Table 1). Grassland and prairie pixels are scattered widely through the East and West Gulf Coastal Plains. Desired site-level conditions were assessed through ancillary data provided by LANDFIRE and USFS. The presence of all four desired conditions was detected on only 3388 acres of grassland pixels, mostly in Oklahoma and Missouri in the transition to the tallgrass prairie of the Central Plains, and some in the Black Belt of Mississippi and Alabama (Figure 3, Figure 5, Table 2).

Sunset at Black Prairie Wildlife Management Area, Lowndes County, Mississippi. Photo by Toby Gray

Table 1: Acreage amounts for each desired condition (columns) within each subgeography (rows) in the Grassland Mask

Subgeography	Grassland	Prairie	Potential	Height > 1m	Veg Cover >80 grass, <20% shrub	Tree Density < 10/acre	Disturbance Return 1-5 years
West Gulf Coastal Plain	11,505,453	355,349	917,764	478,517	2,753,746	1,575,786	1,201,609
East Gulf Coastal Plain	9,523,949	238,948	880,042	1,432,633	1,067,417	559,758	21,775
Mississippi Alluvial Valley	962,743	6,065	782,348	153,492	97,272	301,099	1,260,405
Ozark Highlands	9,770,677	324,683	2,832,766	161,437	3,368,713	2,235,495	105,304
Gulf Coast	424,565	121,040	79,049	115,017	16,057	49,822	108,403
TOTAL	32,187,387	1,046,085	5,491,969	2,341,096	7,303,206	4,721,959	2,697,495

Table 2: Acreage amounts for number of conditions met (rows) within categories of patch size and grassland type (columns) in the Grassland Mask

Number of endpoints met	Grassland < 100 acres	Grassland > 100 acres	Prairie < 100 acres	Prairie > 100 acres	TOTAL
0	7,824,588	9,087,446	548,883	221,232	17,682,149
1	4,589,733	7,151,278	120,816	93,656	11,955,483
2	746,477	1,780,284	4,761	10,624	2,542,146
3	1,781	49,017	12	26	50,837
4	0	3,388	0	0	3,388
TOTAL	13,162,580	18,071,413	674,472	325,538	32,234,003

Acknowledgment:

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Works Cited

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