

# Overview of LANDFIRE outputs for the Ataya Region

Sarah Hagen and Randy Swaty

## Table of contents

Introduction to process . . . . .	1
Current Landscape . . . . .	2
Most Prevalent Existing Vegetation Types . . . . .	2
Existing Vegetation Cover . . . . .	4
Existing Vegetation Height . . . . .	6
Succession Classes Past and Present for the Three Most Dominant EVTs . . . . .	8
Overall pattern of succession classes . . . . .	9
Allegheny-Cumberland Dry Oak Forest and Woodland . . . . .	11
South-Central Interior Mesophytic Forest . . . . .	13
Southern Appalachian Oak Forest . . . . .	15
Reference disturbance amounts for top EVTs . . . . .	16
Acknowledgements . . . . .	17

## Introduction to process

Principles 6 & 9 of the US Forest Stewardship Council Standards call for, among other things, a look at ecosystems past and present across the landscape, plus an assessment of historical vs. current succession classes. This work can be aided by [LANDFIRE](#) data and models, as LANDFIRE produces applicable datasets that cover ‘all lands’ in the US. For example, LANDFIRE Produces a dataset called ‘[Biophysical Settings](#)’ ([BpS](#)) that essentially represents the ‘habitat envelop’ for the various ecosystems of the US. The BpS spatial data is accompanied by [descriptions and models](#) that capture historical disturbance regimes and estimate how much of each succession class (per BpS) would have been on the landscape historically (termed ‘reference conditions’). Typically, analysts compare these estimated succession class amounts past and present per BpS. Additionally, the LANDFIRE [Existing Vegetation Type \(EVT\)](#) can be used to characterize the landscape currently.

In a review of the base datasets for the Ataya project area, experts noted a relative over-mapping of ‘mesic’ ecosystems in the BpS data, and that the EVT data not only captured current conditions relatively well, but also captured what is locally known about the historical landscape. Based on this feedback, Sarah Hagen, Spatial Ecologist with The Nature Conservancy’s (TNC) LANDFIRE team conducted the GIS and data wrangling steps necessary to create and implement a custom process that uses the EVT data as the ‘habitat envelop’ of each ecosystem and the reference conditions from the BpS products to assess past vs. current amounts of succession classes. Randy Swaty (TNC’s LANDFIRE team) wrote up these results and created the charts. Reviewed by Jim Smith (TNC’s LANDFIRE team).

## **Current Landscape**

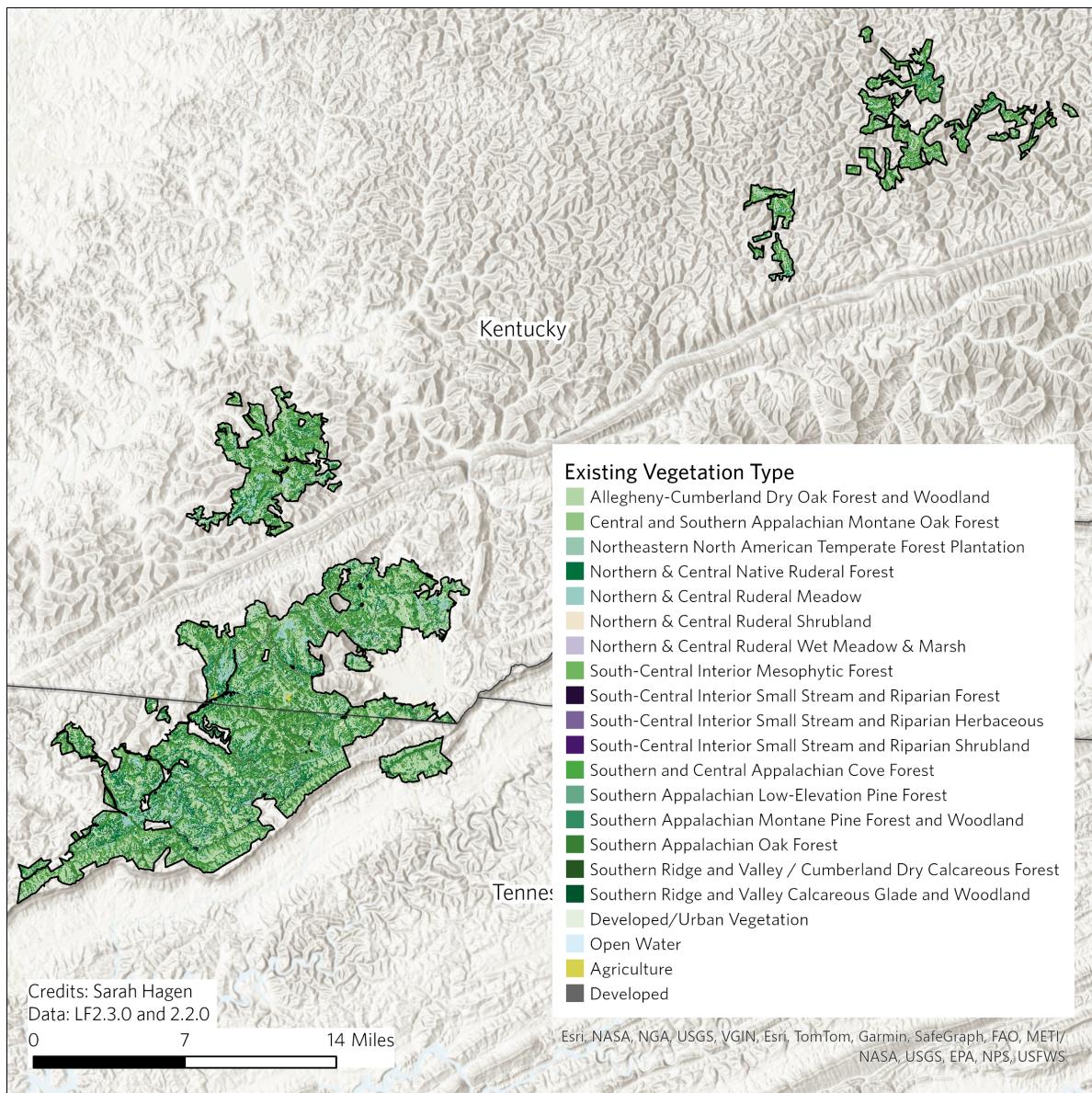
LANDFIRE’s [Existing Vegetation Type, Cover and Height](#) datasets describe current vegetation conditions.

- Existing Vegetation Type (EVT) - represents the current distribution of the terrestrial ecological systems classification, developed by NatureServe for the western hemisphere, through 2016.
- Existing Vegetation Cover (EVC) - represents the vertically projected percent cover of the live canopy layer for a 30-m cell.
- Existing Vegetation Height (EVH) - represents the average height of the dominant vegetation for a 30-m cell.

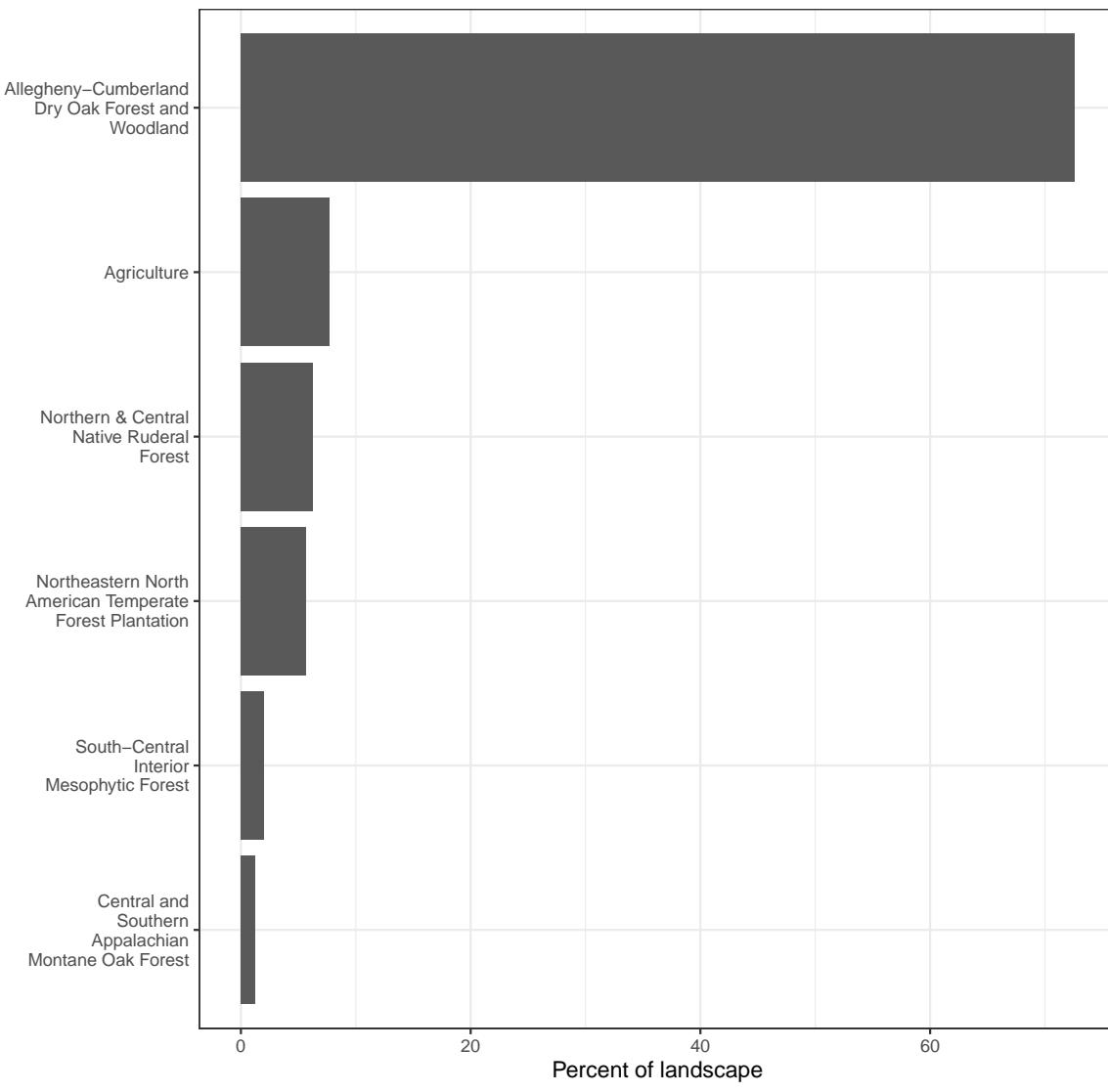
[Read more about LANDFIRE Vegetation Products](#)

## **Most Prevalent Existing Vegetation Types**

Below we map and chart the top 6 EVTs, with the plantation and ruderal forest type lumped together. These types cumulatively add up to more than 95% of the landscape.



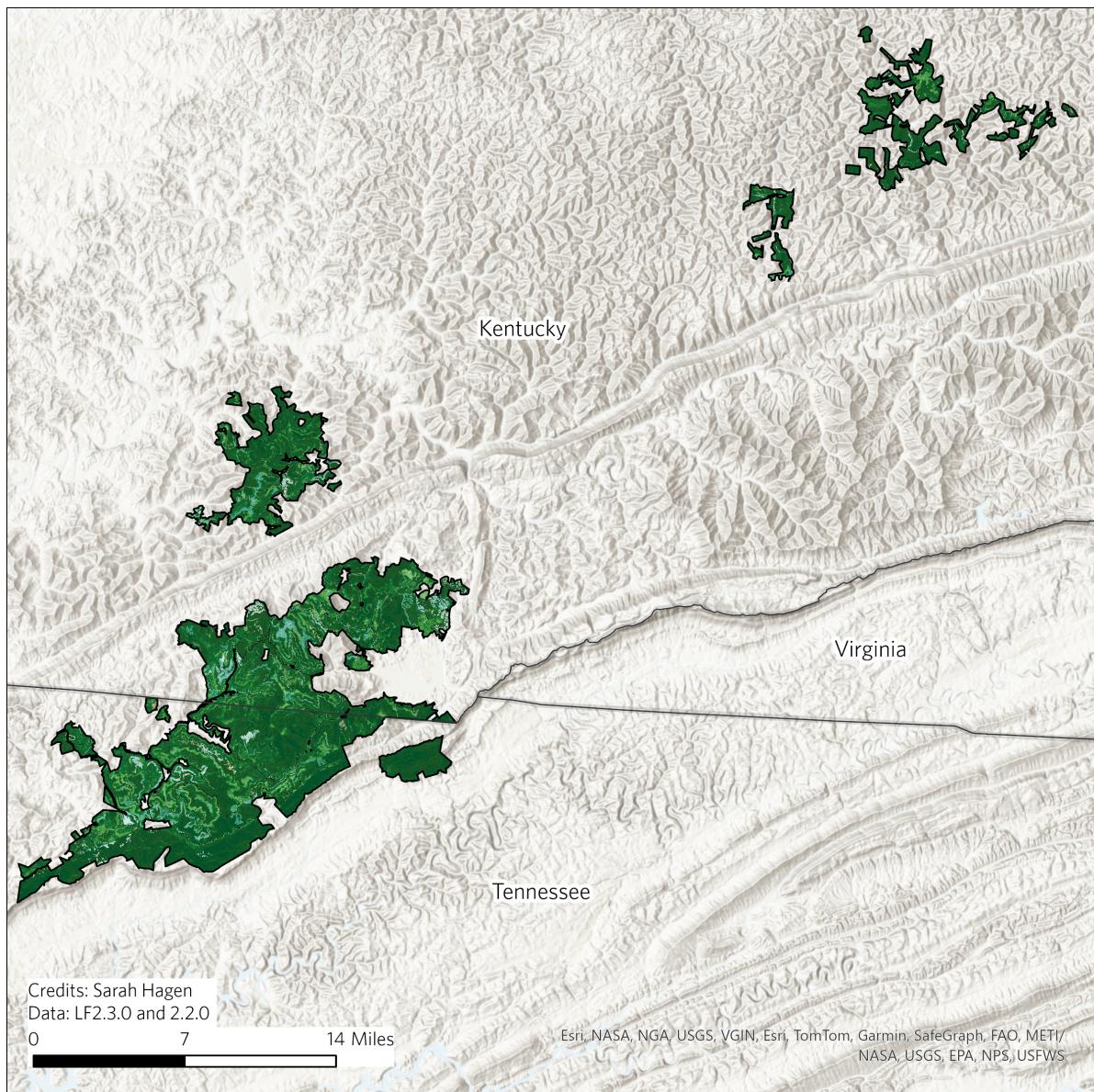
### Top Existing Vegetation Types

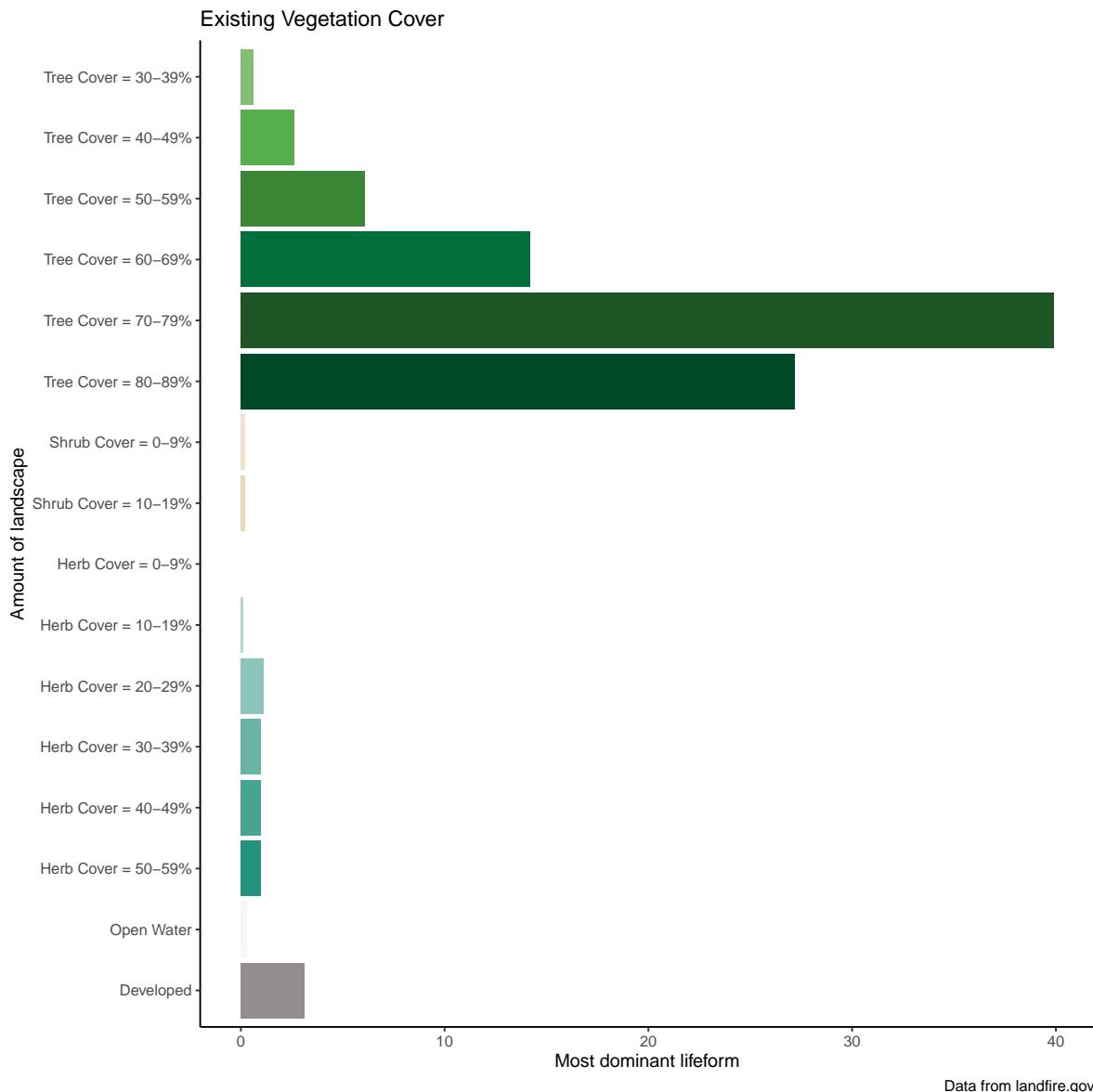


Data from landfire.gov

### Existing Vegetation Cover

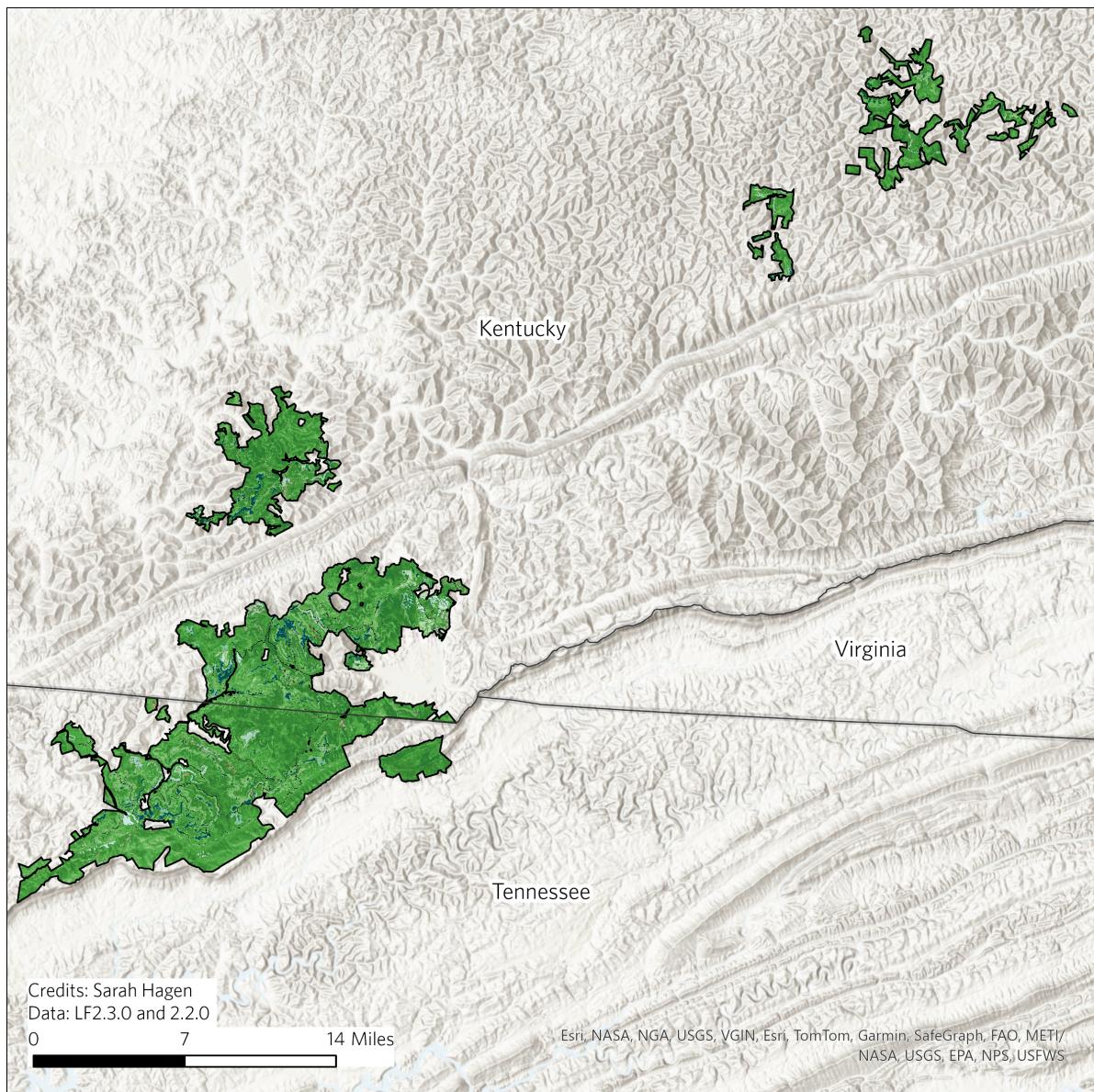
The Existing Vegetation Cover (EVC) map is a visual representation of EVC classifications across the subregion. The chart below the map provides a breakdown of each vegetation cover classification and their relative distribution across the forest.

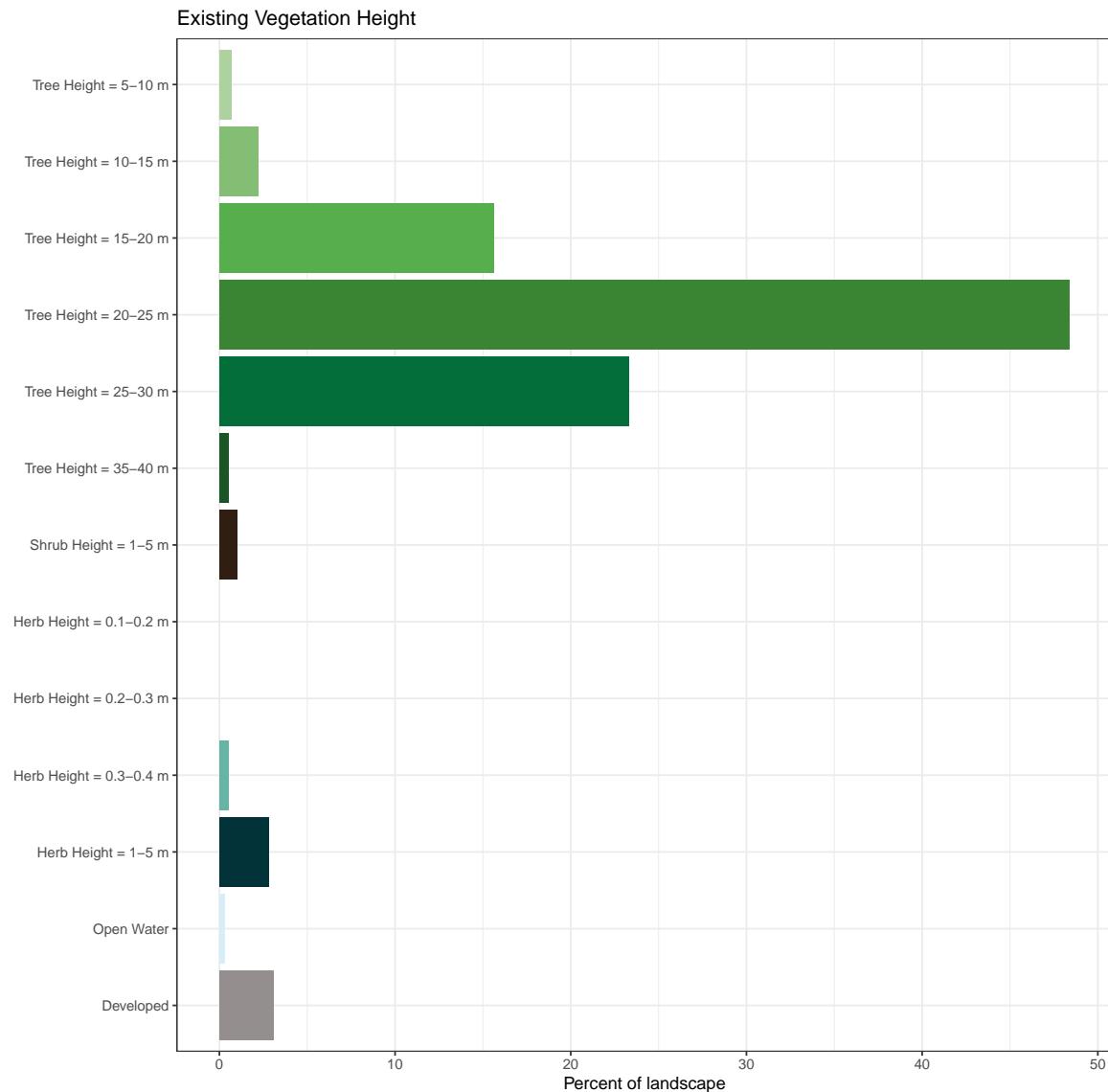




## Existing Vegetation Height

The Existing Vegetation Height (EVH) map showcases EVH across the forest. The chart below the map provides the percentage of the landscape represented by each EVH height.





### **Succession Classes Past and Present for the Three Most Dominant EVTs**

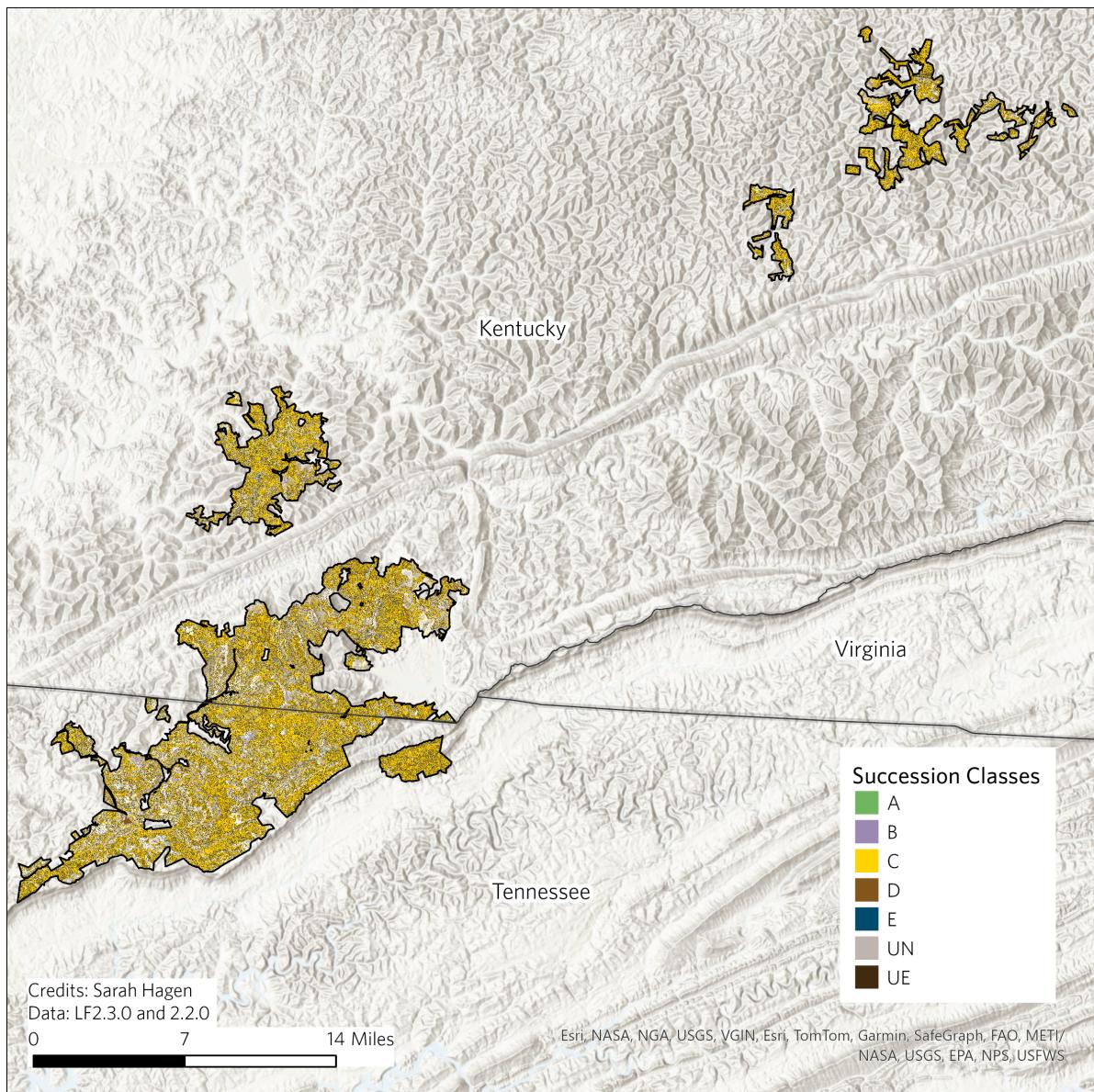
Below are a map of overall succession class patterns for the area of interest, and charts illustrating past (or ‘reference’) and current amounts of succession classes for the 3 most dominant EVTs in the Highlands Project Area. We restrict the analysis to these three as they cover ~80% of the area, and the other types have relatively small extents. Assessing succession class representation at too small of an area may introduce ‘artificially’ high or low values.

## **Overall pattern of succession classes**

Using a novel approach, Sarah Hagen manually created succession classes for the top Existing Vegetation Types. This was done by:

- using the '[Combine Tool](#)' in ArcGIS pro to 'stack' the Existing Vegetation Type, Height and Cover datasets.
- joining relevant attributes to the resultant combine table using the '[Join Field Tool](#)'
- exporting the attribute table as a .csv
- using the succession class rules in the related Biophysical Settings documents to manually assign succession class labels to the representative combinations of height and cover.

Below is a map of the succession classes for the Highlands area.



To further explore succession classes past and present for the top most EVTs, we:

- combined the overall succession class data with the EVT data
- filtered for the top-most EVTs.
- calculated current percent using a pivot table in Excel, then manually entered the reference percents from the related BpS documents.

## **Allegheny-Cumberland Dry Oak Forest and Woodland**

This type is described by NatureServe:

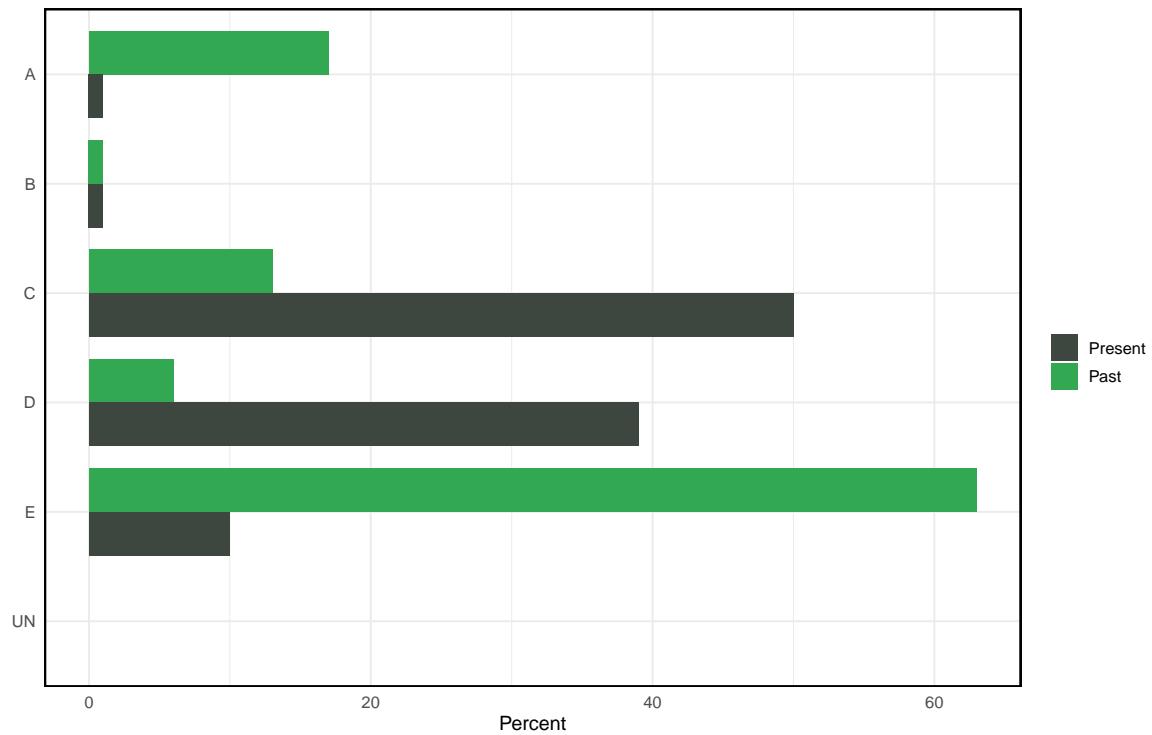
This system encompasses dry hardwood forests on predominately acidic substrates in the Allegheny and Cumberland plateaus, as well as acidic sandstone ridges in the southern Ridge and Valley. Its range is more-or-less consistent with the “Mixed Mesophytic Forest Region” of Braun (1950) and Greller (1988), although it is not a mesic forest type. These forests are typically dominated by *Quercus alba*, *Quercus falcata*, *Quercus montana*, *Quercus coccinea*, with lesser amounts of *Acer rubrum*, *Carya glabra*, and *Carya tomentosa*. Small inclusions of *Pinus echinata* and/or *Pinus virginiana* may occur, particularly adjacent to escarpments or following fire. In addition, *Pinus strobus* may be prominent in some stands in the absence of fire. It occurs in a variety of situations, including on nutrient-poor or acidic soils. Sprouts of *Castanea dentata* can often be found where it was formerly a common tree.

*Quoted from relevant [NatureServe Explorer](#) site.*

LANDFIRE notes that historically this type would have had very rare replacement and mixed fires (800+ and 500+ years respectively), and moderately rare surface fires (~80 yrs). Other disturbances included insects, and small-scale wind events.

To download full BpS description of this type click [here](#).

Succession Classes past and present  
Allegheny–Cumberland Dry Oak Forest and Woodland



*Data from landfire.gov.*

### Succession Class Short Descriptions

- A = Early-Development, grasslands/savanna, herbaceous with white oak regeneration
- B = Mid-Development, closed canopy, white, red and black oak regeneration and big bluestem
- C = Mid-Development, open canopy, mid-seral, white, red and black oaks
- D = Late-Development, closed canopy, late-seral, scarlet, white, red and black oaks
- E = Late-Development 2, closed canopy, late-seral mesophytic species, maples, tuliptree and beech

*No Uncharacteristic Native conditions were indicated in the succession class rules.*

### Summary of succession classes past and present

- LANDFIRE mapped little succession classes A and B on the current landscape.
- There is a substantial over representation of classes C and D when comparing current to LANDFIRE reference conditions and under representation of class E.

## **South-Central Interior Mesophytic Forest**

This type is described by NatureServe:

These high-diversity, predominately deciduous forests occur on deep and enriched soils (in some cases due to, or enhanced by, the presence of limestone or related base-rich geology), in non-montane settings and usually in somewhat protected landscape positions such as coves or lower slopes. The core distribution of this system lies in the Cumberland and Allegheny plateaus, extending into the adjacent southern Ridge and Valley and portions of the Interior Low Plateau where it is located entirely south of the glacial boundary. Dominant species include *Acer saccharum*, *Fagus grandifolia*, *Liriodendron tulipifera*, *Tilia americana*, *Quercus rubra*, *Magnolia acuminata*, and *Juglans nigra*. The abundance of *Tsuga canadensis*, which may be a component of some stands, is being rapidly reduced by the hemlock woolly adelgid (*Adelges tsugae*). The canopy trees may grow very large in undisturbed areas. The herb layer is very rich, often with abundant spring ephemerals. Many examples may be bisected by small streams.

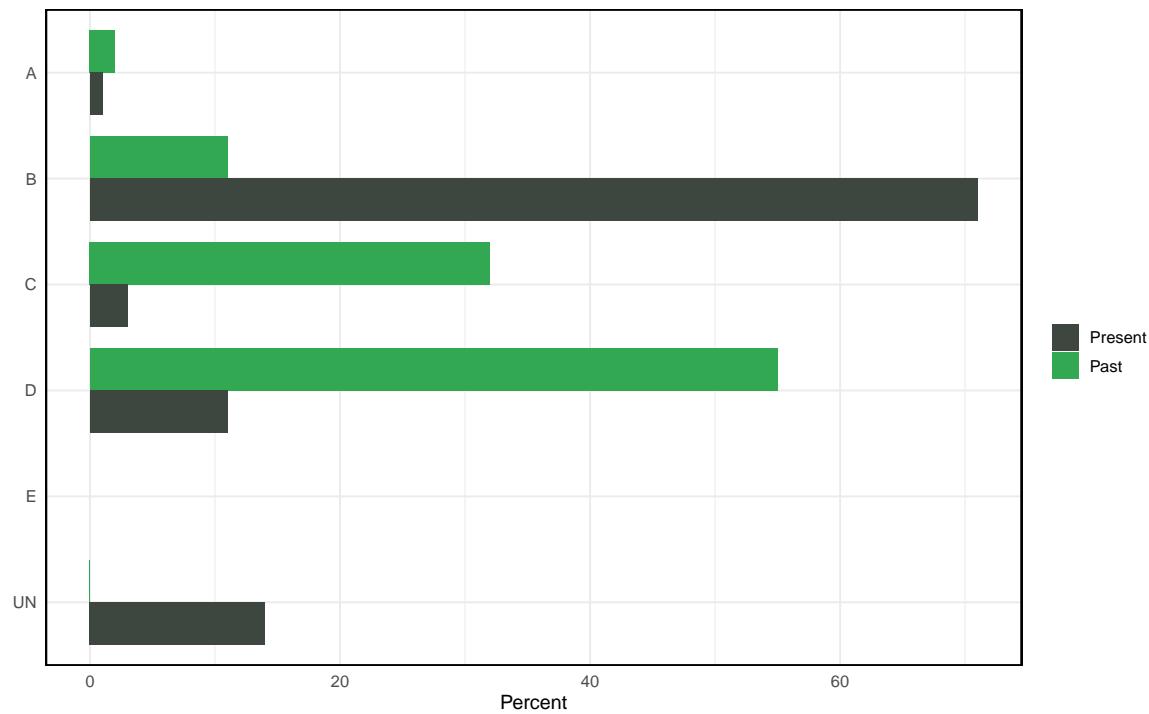
*Quoted from relevant [NatureServe Explorer](#) site.*

LANDFIRE notes that historically this type would have had very rare replacement and mixed fires (800+ and 500+ years respectively), and moderately rare surface fires (~80 yrs). Other disturbances included insects, and small-scale wind events.

To download full BpS description of this type click [here](#).

## Succession Classes past and present

### South-Central Interior Mesophytic Forest



Data from landfire.gov.

### Succession Class Short Descriptions

- A = Early-Development, regeneration of white ash, tuliptree, elm and red maple
- B = Mid-Development, closed canopy, white ash, tuliptree, red oak and red maple
- C = Late-Development, closed canopy, beech, sugar maple, tuliptree and red oak, canopy closure greater than 70%
- D = Late-Development 2, closed canopy, beech, sugar maple, tuliptree and red oak, canopy closure 40-70%

*Native uncharacteristic conditions include all herbaceous and shrub dominated cover-height combinations, and tree dominated combinations where canopy cover is less than 40%.*

### Summary of succession classes past and present

- Succession class B is greatly over represented on the landscape today compared to LANDFIRE Reference Conditions
- Succession class D is relatively underrepresented on current landscape
- There is a substantial percentage of this type mapped as Uncharacteristic Native (UN). These areas are outside of the ‘reference condition’ in terms of height and cover generally.

## **Southern Appalachian Oak Forest**

This type is described by NatureServe:

This system consists of predominantly dry-mesic (to dry) forests occurring on open and exposed topography at lower to mid elevations in the Southern Blue Ridge and Southern Ridge and Valley ecoregions. This is the upland forest that characterizes much of the lower elevations of these areas. The geology and soils can range from acidic to circumneutral or basic, and the vegetation varies accordingly. Soils are usually deep residual soils but are often rocky. Some shallow soils and colluvium may be present locally, but shallow soil environments are more extreme and have more pine.

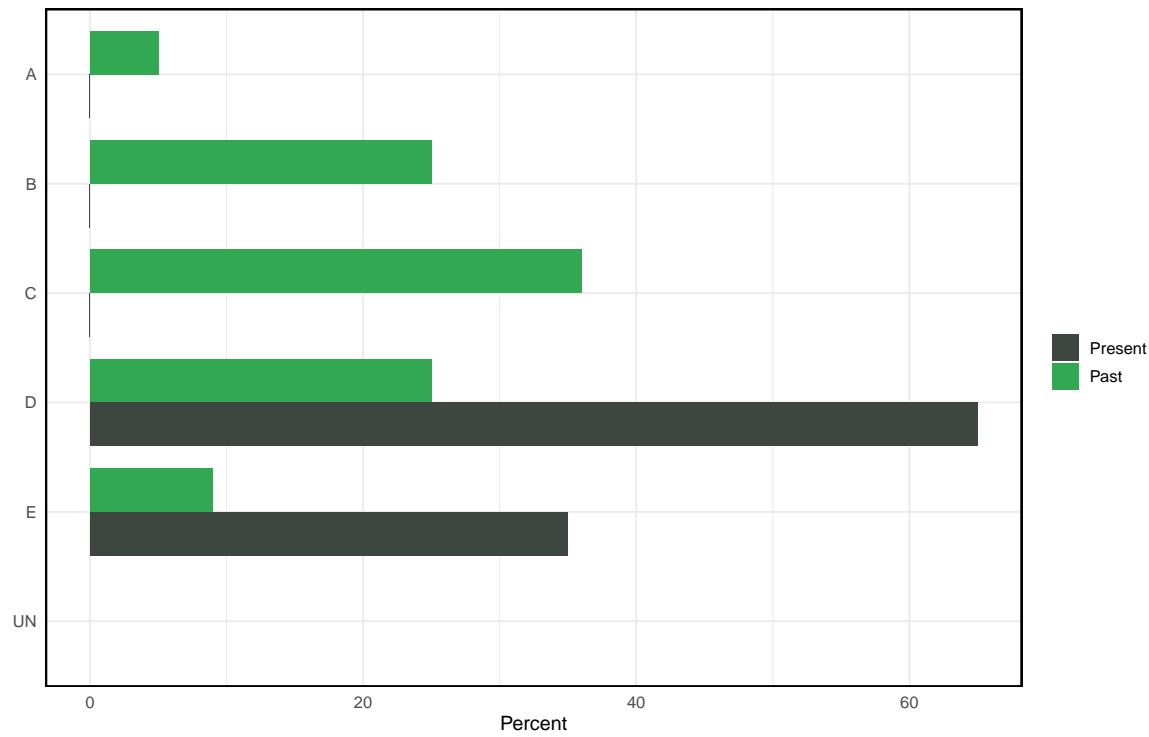
*Quoted from relevant [NatureServe Explorer](#) site.*

LANDFIRE notes that historically this type would have had frequent surface fires (< 25% top kill, ~15yrs return interval, varies based on succession class), and relatively rare mixed (25-75% top kill, ~140 years) and replacement fires (> 75% top kill, ~600 years). Additional disturbances included ice and wind events (50+ year return interval, depending on succession class), and insect attack (70+ return interval, depending on succession class).

To download full BpS description of this type click [here](#).

### Succession Classes past and present

Southern Appalachian Oak Forest



Data from landfire.gov.

### Succession Class Short Descriptions

- A = Early-Development, regeneration of oaks and chestnut
- B = Mid-Development, closed canopy, oaks and chestnut
- C = Mid-Development, open canopy, oaks, chestnut plus mountain laurel
- D = Late-Development, open canopy, oaks, chestnut plus mountain laurel
- E = Late-Development, closed canopy, oaks, chestnut plus white pine

No Uncharacteristic Native conditions were indicated in the succession class rules.

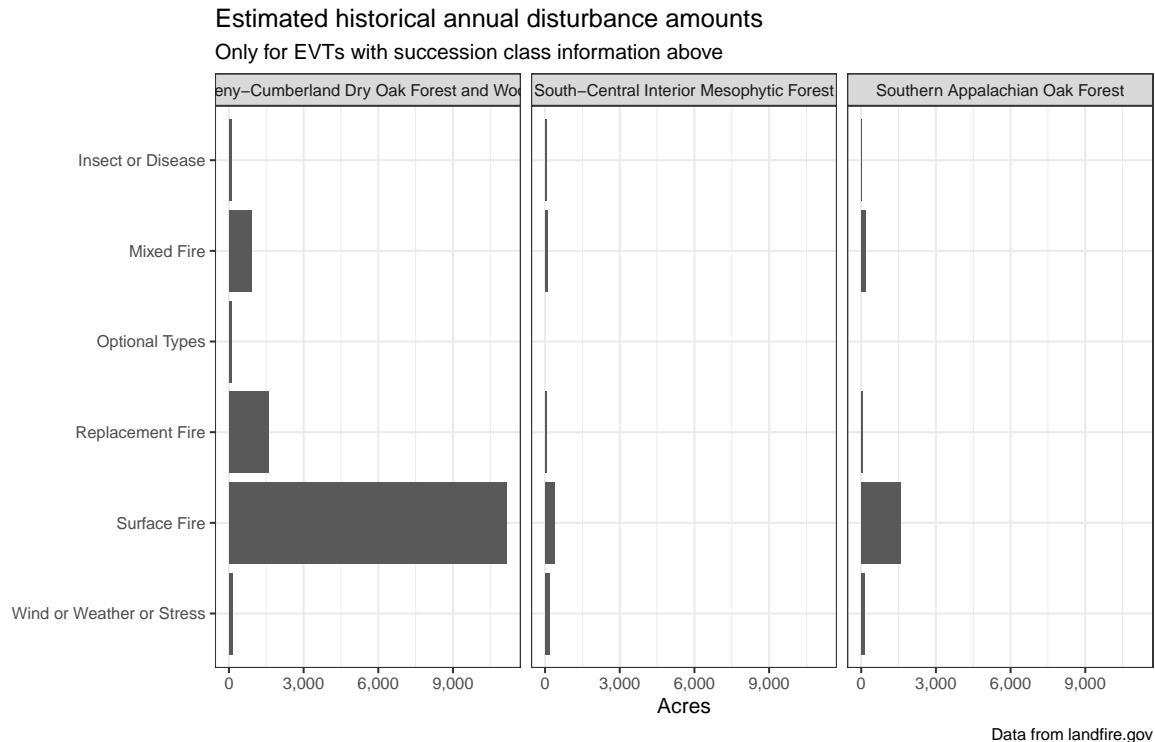
### Summary of succession classes past and present

- Classes A, B and C are essentially missing on today's landscape compared to the past.
- Classes D and E are substantially over represented on today's landscape.

### Reference disturbance amounts for top EVTs

LANDFIRE BpSs include state and transition models that estimate historical annual probabilities for disturbances. Using this information we were able to generate estimated historical

annual disturbance amounts by crosswalking the BpS disturbance information to the relevant EVTs.



## Acknowledgements

- [Myles Walimaa](#) for substantial code contributions
- [Keith Phelps](#) and [Stacey Marion](#) for their original work which illuminated LANDFIRE data issues in the Ataya landscape.