Topic: **Landscape Files - Transition from .LCP to GeoTIFF Landscapes**

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Paper Summary:

As technology advances adjustments need to be made for improved performance. In the wildland fire modeling arena, the time has come where a transition is needed from landscape (.LCP) file format to GeoTIFF file format in order to realize numerous benefits. Landscapes, as a bundled product of required layers, are not going away, only the file format is changing. Although landscape files will be delivered as GeoTIFF files (.tif) instead of the unique .lcp file format, they will still be referred to as 'landscapes' (called landscape.tif instead of landscape.lcp). The planned transition time is during 2024.

Background:

A landscape (.LCP) file is a multi-band raster format used by geospatial wildland fire behavior and fire effects decision support systems such as FARSITE and FlamMap. The bands of an .LCP file store data describing terrain, tree canopy, and surface fuel characteristics. The landscape file defines your potential analysis area and is a required input to run the geospatial fire models. Many LCP's are derived from LANDFIRE data. There is no better terminology for a product that digitally represents the spatial alignment of terrain and vegetation. Unfortunately, over the years, the .lcp format/file extension name became synonymous with the landscape product itself. To alleviate confusion, during this transition, the old file format should be pronounced phonetically (the '*dot ell see pea* landscape') to differentiate the older file format from the newer 'GeoTIFF landscape' or, simply, 'landscape'. In future documentation, the file extension shorthand should no longer be used and as this transition occurs with the geospatial modeling systems will require a landscape, but not an .lcp. Given technological advances the wildland fire landscape structure will be transitioning from .LCP to GeoTIFF landscapes. Models such as FlamMap, FARSITE, FSPro, and RANDIG have been and are wrapping up transitioning to GeoTIFF landscape use. This is a coordinated effort across USDA Forest Service and DOI.

With the release of the Interagency Fuel Treatment Decision Support System (IFTDSS) and the development of a Fire Modeling Services Framework (FMSF) which builds upon the Service Oriented Architecture (SOA) construct of using multiple services (data interchange service, data/information management service, connectivity service, directory service, and operating system service) for repeatable business work enables us to take advantage of these technological advances. The FMSF provides an overarching structure that ties together the business rules, data, models, and underlying technology in a framework to ensure models, tasks, and functions are all aligned in purpose, scope, and end product result. The FMSF is serving the geospatial decision support systems (listed above FlamMap, RANDIG, etc.) to applications as a Model-As-A-Service (MaaS) starting with IFTDSS and WFDSS (NextGen WFDSS). There is no user interface with the FMSF as it is structured for machine to machine communications. In support of this MaaS there are other services being implemented such as but not limited to the LANDFIRE Product Service (LFPS). The move to a cloud-based service's architecture required the ability to pass data though web API's without loss or latency. This is important for both inputs and outputs for data consistency with improved performance and faster results. There is

less system downtime, no queuing of analysis and more rapid development as application developers (e.g. IFTDSS, WFDSS) do not have to deal with the complexities of building, running, and maintaining models. As prototyping work has been done, it was determined that for landscape files, a GeoTIFF file format is best suited to effectively and efficiently meet SOA needs.

GeoTIFF Benefits and Outputs/Package:

The primary benefits of moving to GeoTIFF are:

1. Built in compression which greatly reduces file size and/or the need to compress externally.
2. Binary data storage greatly reduces file size over text formats.
3. GeoTIFF allows for an unlimited number of layers in a single file.
4. GeoTIFF has built-in projection and coordinate system information (no .prj file is necessary).
5. GeoTIFF is a mature, well documented file format standard
6. GDAL has added the ability to add custom tags and metadata to individual bands in a GeoTIFF*, such as:
    a. Layer Name
    b. Layer Units

*Unfortunately ESRI products do not display the GDAL metadata tags, although any application utilizing the GDAL library can read these tags. For example, QGIS reads and displays these tags.

File and data transfer management is much less complex using GeoTIFF. For example, SpatialFOFEM has over 100 selectable outputs. Using ASCII grids, each selected output would produce an individual .asc file and an accompanying projection (.prj) file. SpatialFOFEM can either output each output layer to a unique GeoTiff file, or package all output layers into a single multiband GeoTiff file. The use of GeoTIFF file formats can significantly reduce the number of output files and potentially reduce over 200 files to one single file, while at the same time reducing disk and data transfer usage.

Transition:

Given the technological advances and benefits outlined in this briefing paper the plan is to transition from .LCP to GeoTIFF landscapes during the 2024 timeframe.
The landscape development work will wrap up in 2024 where GeoTIFF landscapes will be offered as part of the LFPS. LANDFIRE will continue to provide users with prior years data / product versions until such time as they are archived.