Title:
(Relatively) Automatic Forest Layer!

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Abstract:
The availability of localized forest layers is quite scarce, generally speaking. Most forest layers that are publicly available often are acquired at state-wide or national scales, which are not particularly useful for county-level mapping applications. So how does one go about developing a usable forest layer for their county? One option would be to pay an orthophotography vendor to create one as part of their contract for remote sensing services, possibly in a topographic/planimetric phase of the project. Another option, which may prove more affordable, while giving the county much more in-house control of the creation of the layer, would be to generate one based on USGS Topographic DRG's. These maps were widely produced at a scale of 1:24,000, which is quite useful for counties. Here I will demonstrate the methodology and workflow I developed to create a county-wide forest layer for Boone County Missouri, using this resource.

I developed a custom methodology and workflow to create an automatic forest layer for Boone County based on USGS Topographic Digital Raster Graphic maps of Boone County. This work represented extensive, intensive, repeatable, geoprocessing of this raster data source into workable, useful-scale, GIS polygon datasets of forest coverage for the entire county, developed at PLSS Township-level area extents (to produce manageable file sizes). Publicly-available forest data covering all or a portion of Boone County were done at very small scales, and are not very useful at a county level. And raster extraction of forested areas using color, or even black-and-white, orthophotos, proves difficult at best, and unreliable at worst, based on a range of pixel tone values, as dissimilar-to-forest features (i.e. ponds, grassy fields, etc.) often have similar-to-forest tone values, which results in inclusion of extraneous features with the forested areas, not to mention resulting gaps within forested areas because of varying tones of foliage, shadows, and visible ground area showing between branches in leaf-off conditions. The USGS Topographic DRG's were widely produced at a scale of 1:24,000, which is quite useful for counties, and they have only one tone value representing forested areas. This greatly simplifies the process, without including the aforementioned extraneous features.

In just a few weeks, using this automated methodology, I created a comprehensive, county-wide forest layer for Boone County. Developing even a rough forest layer completely by hand would have taken many times longer. Of course, the automatically generated forest layer needed to be updated to reflect current forest extents since the USGS Topo maps were created, but this gave us an excellent starting point for this process.

Listed below are the steps I took to create the automatic forest layer using geoprocessing tools in ArcGIS Toolbox. The specific tool used in each step is in bold type. Township 3 was the pilot area, and this process was repeated from step 10 for the rest of the townships as well.

Workflow for Forest Layer Creation

1. Resampled USGS Topo DRG raster (default Output Cell Size – same as input; NEAREST Resampling Technique) **– Data Management Tools—Raster—Resample**
2. Built Attributes **– Data Management Tools—Raster—Build Raster Attribute Table**
3. Calculated Statistics **– Data Management Tools—Raster—Calculate Statistics**
4. Extracted by Attributes (where Value = 5) **– Spatial Analyst Tools—Extraction—Extract by Attributes**
5. Clipped raster based on rectangular extent of county boundary **– Data Management Tools—Raster—Clip**
6. Extracted by Mask using county boundary **– Spatial Analyst Tools—Extraction—Extract by Mask**
7. **Spatial Analyst toolbar – Convert – Raster to Features** -Polygon (Generalize lines checked)
8. Smoothed all features with a maximum allowable offset of 5 map units **– Advanced Editing toolbar – Smooth**
9. Buffered 10 feet (Dissolve Type ALL) **– Analysis Tools—Proximity—Buffer** [Dissolve failed (too large) so must clip to individual townships and then dissolve]
10. Exported Township 3 to new shapefile (not necessary, just select within Townships layer before next step)
11. Clipped to extent of Township 3 **– Analysis Tools—Extract—Clip**
12. Dissolved (Dissolve_Fields: GRIDCODE and BUFF_DIST) (Create multi-part features unchecked) **– Data Management Tools—Generalization—Dissolve**
13. Erased Township 3 using forest layer (gave me a polygon for all areas of Township 3 that didn't already have a forest layer polygon – to fill in gaps) **– Analysis Tools—Overlay—Erase**
14. Edited Township 3 Erased layer by deleting polygons for areas that are not forested – Must explode multi-part features first
15. Unioned both layers together (Gaps Allowed checked) **– Analysis Tools—Overlay—Union**
16. Dissolved resulting layer (Create multi-part features unchecked) (all internal gaps now filled in) **– Data Management Tools—Generalization—Dissolve**
17. Exported shapefile to Township3 folder (Township3Forest.shp)

The reason I say this is a "relatively" automatic forest layer is because of step 14 requiring interactive editing of the layer polygons in an edit session.