

Introduction

As development introduces competing land uses into forest and grassland landscapes, the public expresses concern for landscape patterns through headline issues such as urban sprawl and fragmentation. Resource managers need a deeper understanding of the causes and consequences of landscape patterns, to know if, where, and how to take any needed actions. The spatial arrangement of the environment affects all ecological processes within that environment; the task for resource managers is to arrange a forest or grassland in an appropriate way to provide the desired balance of biodiversity, water quality, and other amenities. National assessments of landscape patterns can help to inform those decisions by documenting the status and trends of the landscape context of natural resources.

Forest fragmentation, landscape mosaics, and other land cover patterns have been assessed in previous national technical reports by the national Forest Health Monitoring (FHM) Program of the Forest Service, U.S. Department of Agriculture. However, because of the size and complexity of the databases, the reporting has necessarily been limited to regional statistical

summaries, and the relatively coarse-scale maps that have been presented could not portray the wealth of local detail contained in the databases. As a result, it has been difficult for readers to visualize land cover patterns in specific locations or to interpret their meaning in relation to other geographic features. To alleviate that problem, national maps have been prepared as an online database, which permits readers to see high-resolution maps of land cover patterns for any specific location. All that is required is an Internet connection, a geographic browser, and the keyhole markup language (KML) documents, which serve as the user interface for the online databases. Now, readers can access the national results in full spatial resolution for any specific location and can overlay the land cover pattern maps with other online databases such as aerial photography and road maps to better interpret the meaning and implications of land cover patterns. The objectives of this chapter are to describe the available online databases of land cover patterns and the use of the KML documents with a freely available geographic browser. Visualization examples are provided for three of the landscape pattern maps that have been used in forest assessments.

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Chapter 3. Online Maps for Visualizing Landscape Patterns at High Spatial Resolution

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Overview

The online database currently comprises three national maps that were derived from the 2001 version of the National Land Cover Database (Homer and others 2007), a national map that portrays 16 types of land cover at a spatial resolution of 0.09 ha per pixel. The derived maps portray three land cover pattern indices at a spatial resolution of 0.09 ha per pixel—forest area density, land cover mosaic, and forest spatial pattern—which have been selected for reporting in various Forest Service assessments including those by FHM, the Resource Planning Act group, and the Montreal Process Criteria and Indicators group. On each map, the color of a 0.09-ha pixel indicates the land cover pattern in a surrounding fixed-area neighborhood, and the maps can, therefore, be interpreted as maps of land cover pattern context for each pixel.

The map of the forest area density index (FDEN) shows the proportion of the surrounding 15-ha neighborhood that is forest. In previous assessments, FDEN has been used to answer the question “how much forest is surrounded by how much other forest” (Riitters and others 2002). The map of the land cover mosaic index shows the mixture of three major land cover types (developed, agriculture, seminatural) in the surrounding 15-ha neighborhood. That

index has been used in previous assessments to answer the question “what is the anthropogenic land cover context of forest” (Riitters and others 2008). The forest morphological spatial pattern index (MSPA) shows the physical structure of which a forest pixel is part (Vogt and others 2007). The MSPA will be used in upcoming assessments to report on, for example, the amount and location of forest and grassland which exists as part of “core,” “corridor,” and “edge” structures. The three indices are described in more detail at the World Wide Web sites listed in table 3.1.

Table 3.1—Online sources for the geographic browser and keyhole markup language (KML) documents mentioned in the text

Google Earth geographic browser download page:
<http://earth.google.com/>

Note: Version 4 or later of Google Earth is required.

Land cover mosaic index information page and KML download page:
<http://forestthreats.org/tools/landcover-maps/lcm>
http://data.forestthreats.org/fhm/us-mosaic_v1_1-NEMAC_EDIT.kml

Forest spatial pattern index information page and KML download page:
<http://forestthreats.org/tools/landcover-maps/mspa>
http://data.forestthreats.org/fhm/us-mspa_v1_1-NEMAC_EDIT.kml

Forest area density index information page and KML download page:
<http://forestthreats.org/tools/landcover-maps/fden>
http://data.forestthreats.org/fhm/us-fden_v1_1.kmz

A geographic browser and a KML document are required to access an online map. An example of a freely available geographic browser for popular computing platforms is Google Earth, which can be obtained at the URL shown in table 3.1, but any other geographic browser that supports KML should work as well. The locations of the three KML documents for the three land cover pattern indices are also shown in table 3.1. After starting the geographic browser application, a KML document is opened from that application, and a national map of that landscape pattern index is initialized. The user is then free to navigate the maps with built-in browser functions such as “pan” and “zoom.”

Some geographic browsers automatically provide a background of recent aerial photographs, and that capability can be used to help interpret the land cover pattern maps. One approach is to open two copies of the geographic browser, displaying the background photography in one copy and a map of land

cover pattern in the other copy (fig. 3.1). Some geographic browsers also support user-controlled transparency, which permits the overlay of a land cover pattern map upon the background aerial photography within one copy of the browser. The transparency of the overlaid land cover pattern map can be adjusted so that the background aerial photography can be seen “through” the land cover pattern map (fig. 3.2).

Literature Cited

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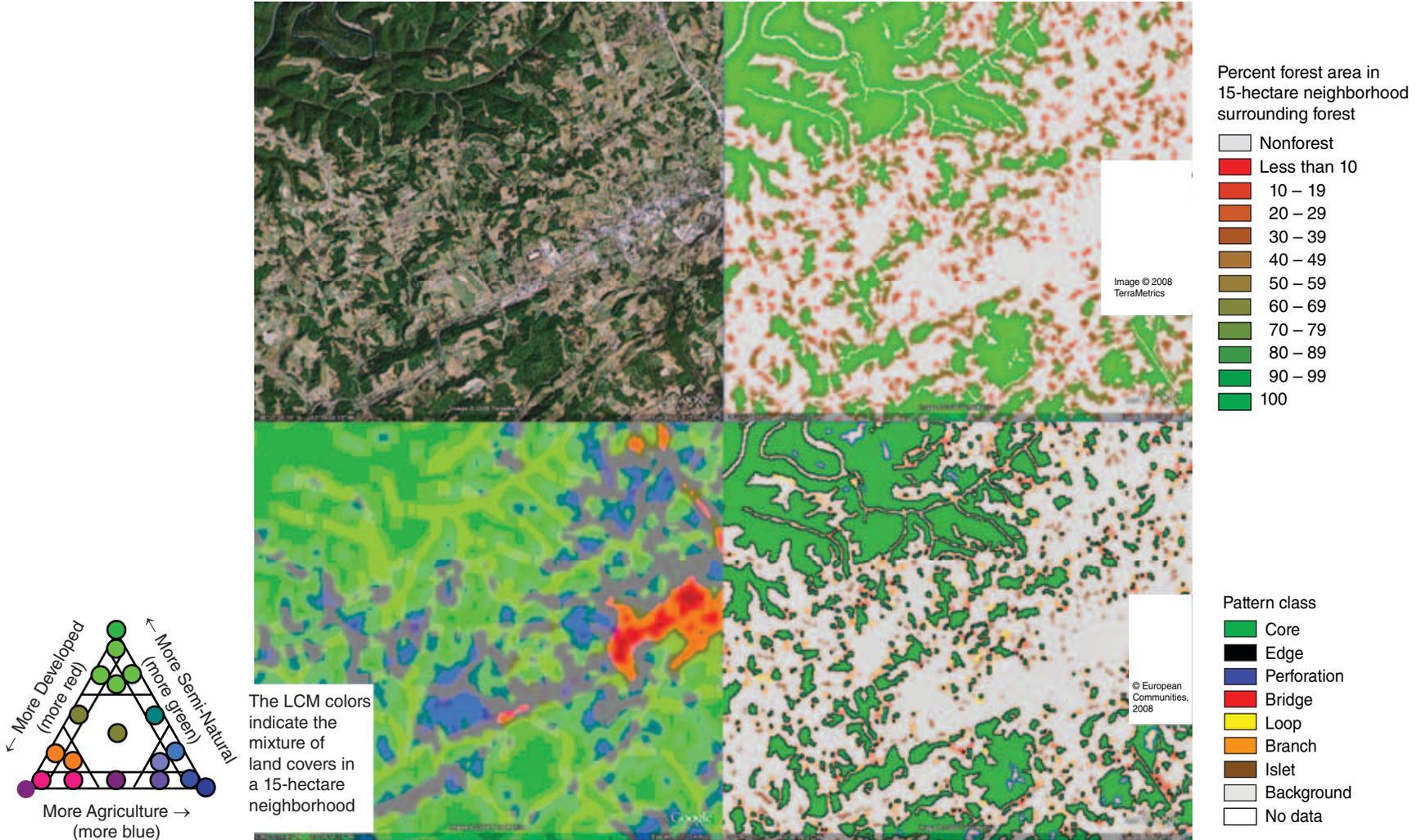


Figure 3.1—Online browsing of national land cover pattern maps is illustrated for a landscape near New Tazewell (Claiborne County), TN. Clockwise from top left: background aerial photography provided by the geographic browser service; the forest area density index (FDEN); the forest spatial pattern index (MSPA); and the land cover mosaic index (LCM). (Data sources: Google, TerraMetrics, Forest Service, U.S. Geological Survey)

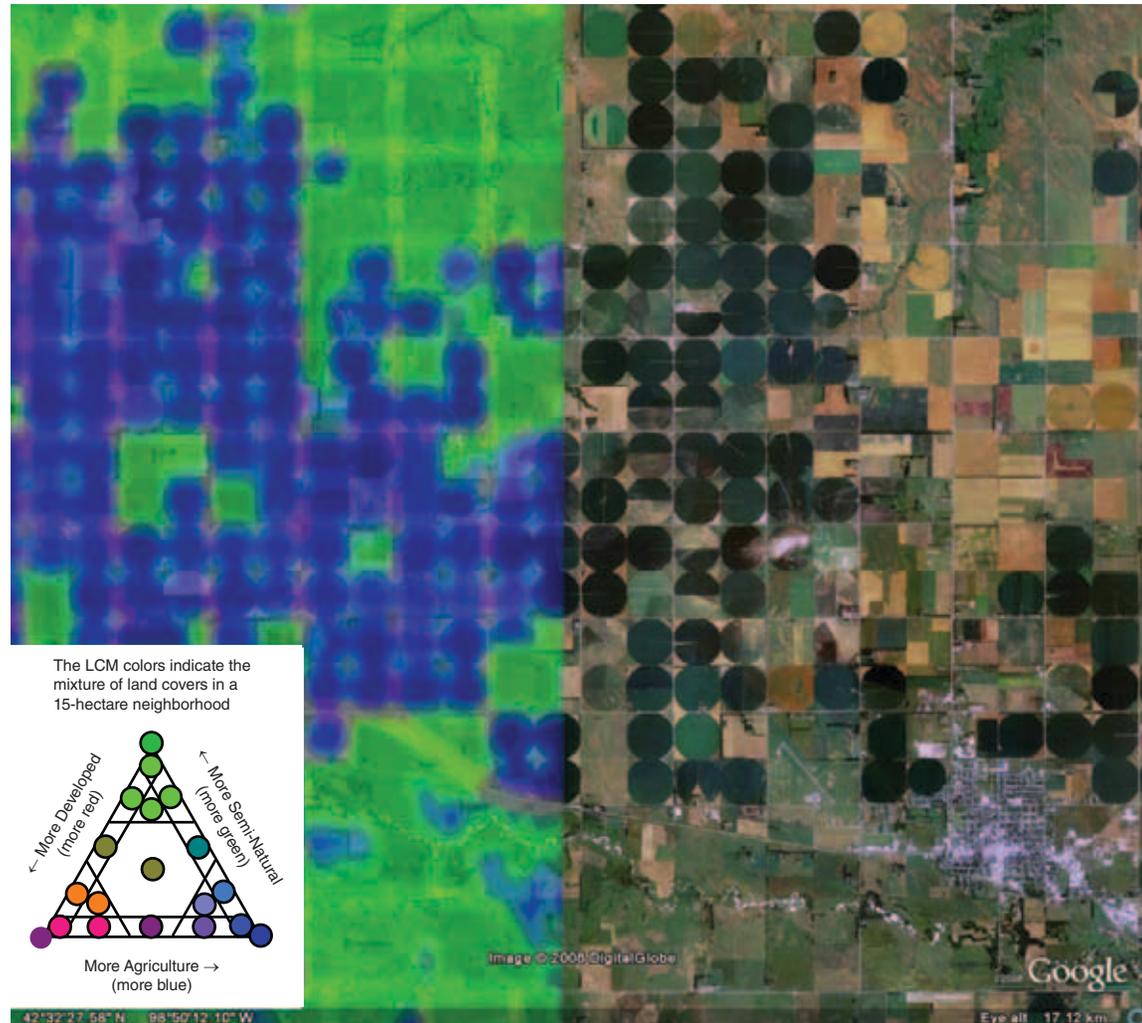


Figure 3.2—Utilizing the transparency option provided by some geographic browsers to explore the land cover mosaic index (LCM) in relation to background aerial photography. In this landscape near O’Neill, NE, the dominant land cover patterns are created by the center-pivot crop irrigation systems, which are visible in aerial photography (right) as dark-green circles separated by a road network. In the adjacent region (left), the LCM portrays the continuation of that pattern as blue circles representing concentrations of agriculture land cover separated by cyan regions representing the road network. Note that the LCM map (left) has been made partially transparent to enable inspection of LCM in relation to the background aerial photography. (Data sources: Google, TerraMetrics, Forest Service, U.S. Geological Survey)