Cartographic Standards To Improve Maps Produced by the Forest Inventory and Analysis Program

Charles H. (Hobie) Perry[1] and Mark D. Nelson[2]

Abstract.—The Forest Service, U.S. Department of Agriculture's Forest Inventory and Analysis (FIA) program is incorporating an increasing number of cartographic products in reports, publications, and presentations. To create greater quality and consistency within the national FIA program, a Geospatial Standards team developed cartographic design standards for FIA map products. We present an overview of FIA's proposed cartographic requirements and guidelines, descriptions of specific map elements, and examples of map templates for State reports. The full set of FIA cartographic design standards are expected to be published in a Research Station publication and on the Internet.

Introduction

The Forest Service, U.S. Department of Agriculture's Forest Inventory and Analysis (FIA) program produces data, information, and knowledge about the extent, condition, status, and trends of the Nation's forest resources across all land ownership categories (Smith 2002). Traditionally, FIA data and information have been provided as tabular summaries for estimation units such as States and counties (e.g., Schmidt 1997). Possessing greater understanding of Geographic Information Systems (GISs), current FIA customers require enhanced geospatial analysis of forest resources. FIA scientists and analysts are meeting this need by incorporating an increasing number of maps into their reports, publications, and presentations (e.g., McWilliams *et al.* 2005; Woodall *et al.* 2005).

The interagency Federal Geographic Data Committee (FGDC) was established by the Office of Management and Budget in 1990 for the express purpose of "promot[ing] the coordinated development, use, sharing, and dissemination of geospatial data on a national basis" (FGDC 2006a). With the perspective that consistent standards make it easier to develop and use spatial data, FGDC actively solicits participation from governmental and private entities in standards development (FGDC 2006b). In addition to developing standards for maintaining geospatial data, many diverse Federal agencies have developed standards to meet their cartographic needs (i.e., the visual display of geospatial data within map products). For example, the U.S. Geological Survey maintains National Mapping Program Standards for printed maps as well as their underlying digital data (USGS 2006). Likewise, the Oregon office of the U.S. Bureau of Land Management and Natural Resources Canada also provide standards for cartographic products (Natural Resources Canada 2006a, 2006b; BLM 2006). Most of the standards provided by these organizations are very detailed; some go so far as to specify the exact symbology (e.g., shape, color, line width) required to represent every feature on a map.

FIA recognizes a need to ensure quality and consistency in their cartographic products (e.g., map standards for State reports). Unfortunately, none of the traditional Federal agencies mentioned above have created standards that meet these needs. In response, FIA's Remote Sensing Band established a cross-band task team known as the Geospatial Standards Team (GeoTeam) to recommend (1) cartographic standards associated with FIA national and regional map products and (2) a list of relevant GIS-base layers for the FIA national program. Our objective in this article is to introduce a working draft of the GeoTeam's cartographic design standards and encourage their use by FIA analysts and partners.

[1] Research Soil Scientist, U.S. Department of Agriculture (USDA) Forest Service, Northern Research Station, 1992 Folwell Avenue, St. Paul, MN 55108. E-mail: charleshperry@fs.fed.us.

[2] Research Forester, USDA Forest Service, Northern Research Station, 1992 Folwell Avenue, St. Paul, MN 55108.

Methods

Our process for standards development began with a casual review of existing cartographic products released by a range of FIA analysts. Some of these products were included in State reports while others were created for specific national tasks. It was clear from this review that many analysts were capable users of GIS, but they lacked training in traditional cartography and principles of design. The agencywide availability of ArcGIS software made it easier to create maps, but no standards existed to facilitate the creation of high-quality maps.

A number of excellent cartographic resources are available as texts and Web sites (Brewer 2005, Geographer's Craft Project 2006, Krygier 2005, Slocum 2005). A review of these resources reinforces the notion that effective maps have several elements in common (e.g., a depiction of scale, a legend, a list of data sources, and a title). These elements should be addressed in any cartographic standards document.

A comparison of extant cartographic products with traditional cartographic theory suggests the rough structure of the future standards. The cartographic standards for the FIA program would need to be different than those currently promulgated by other Federal agencies. The national FIA program is implemented as a confederation of regional programs, and analysts want to express creativity in their cartographic products. Furthermore, most FIA maps are designed to augment State reports and other publications, not to be mass-produced as quadrangle sheets or visitor maps. A set of highly prescriptive standards like those released by the U.S. Geological Survey (2006) would lead to consistency and quality, but they would not be practical or well received. Fortunately, we discovered that King County, WA, had encountered a similar dilemma, and its local task team developed a set of cartographic standards (Cartographic Standards Workgroup 2006) that would serve as a model for our efforts.

Standards

The standards we developed consist of both requirements and guidelines. Together, these requirements and guidelines will facilitate high-quality maps that "brand" FIA cartographic products in much the same way that everyone recognizes a U.S. Geological Survey quadrangle map or a national forest map.

The standards pertain to State maps in FIA reports, national maps, and other FIA map products. Requirements are prescribed for all maps produced for public distribution. Generally, these requirements are written for those elements essential to high-quality cartography or are required by the national FIA program (e.g., plot security). Guidelines are provided for some map elements to assist analysts with map making; guidelines also address design features where creativity could be used to create unique maps that still fall within our hopes for an FIA "brand."

Figures 1 through 4 present State map templates (using Wisconsin as an example) with text boxes that describe the current proposed requirements (10 in all) and a sample of the guidelines (12 of 24), linked to specific elements on the example maps. As can be seen in the figures, FIA's cartographic design standards pertain not only to traditional county-based choropleth maps, but also to dot maps and pixel-based land cover maps. Note that the standards do not address every detail of every map element. Rather, the standards provide for more consistency, efficiency, and quality while allowing the map producer some flexibility and creativity.

Summary

Effective cartographic communication depends upon following some basic principles. By considering the balance, proportion, and emphasis of different map elements, we developed cartographic standards for the FIA program; our intent is to facilitate the creation of good maps. The implementation of consistent cartographic standards provides a common 'look-and-feel' for map products and thus creates a visual brand for the FIA program. A more complete description of each FIA cartographic requirement and guideline will be documented in a forthcoming publication.

Figure 1.—*A subset of the proposed cartographic standards (two requirements and three guidelines) using a reference map for illustration.*

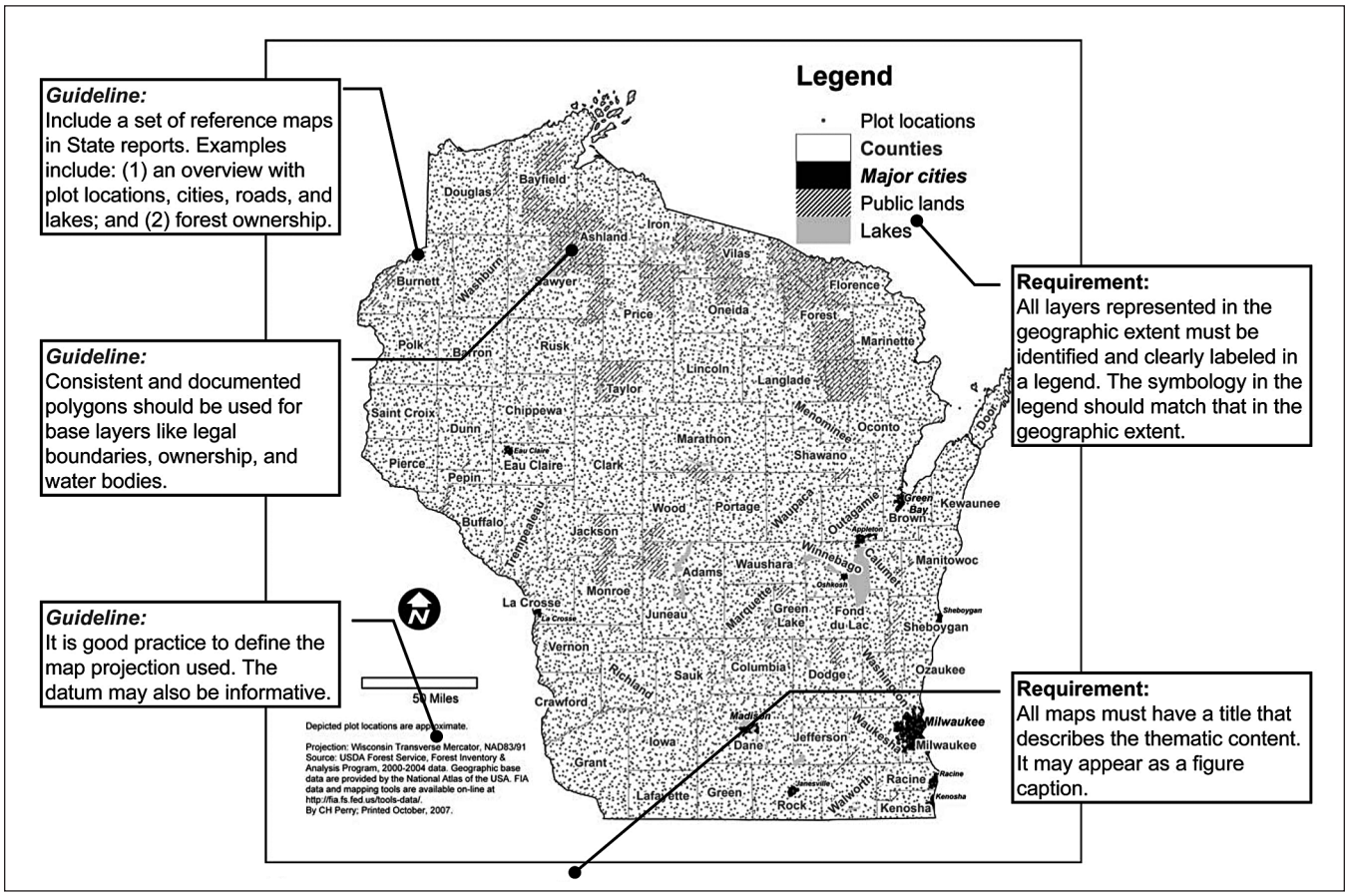


Figure 2.—*A subset of the proposed cartographic standards (three requirements and three guidelines) using a county-based map for illustration.*

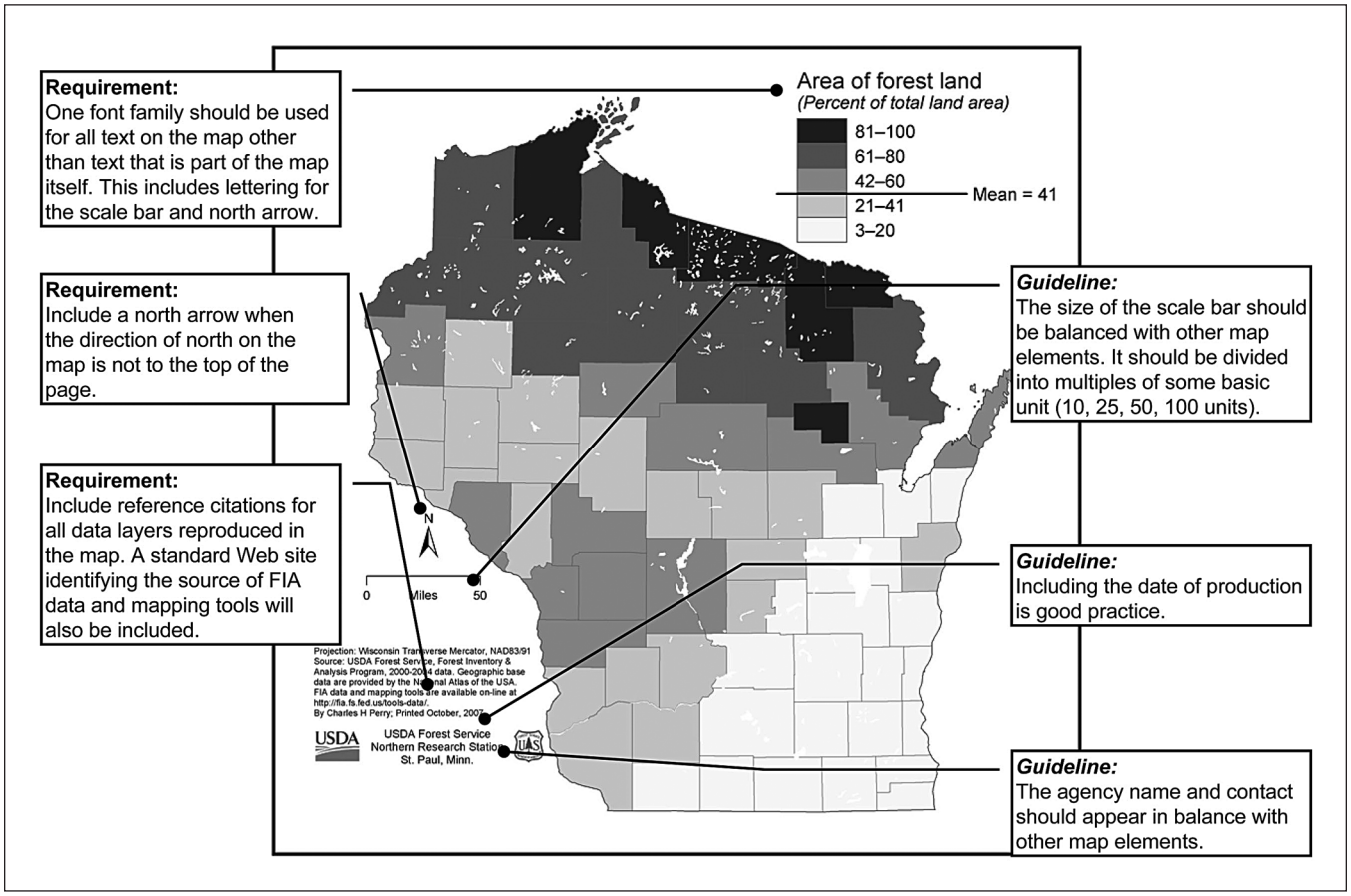


Figure 3.—*A subset of the proposed cartographic standards (two requirements and three guidelines) using a pixel-based map for illustration.*

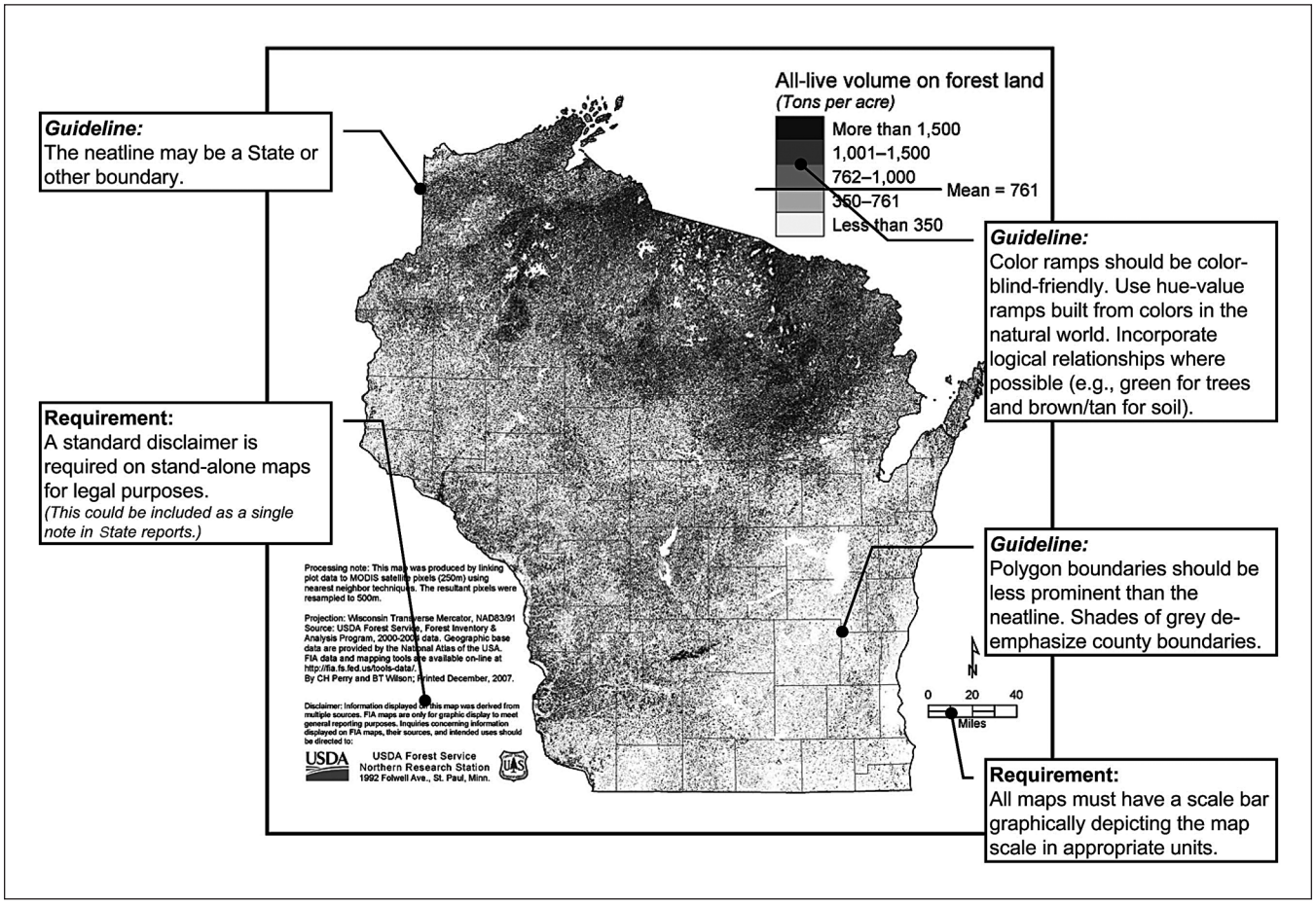
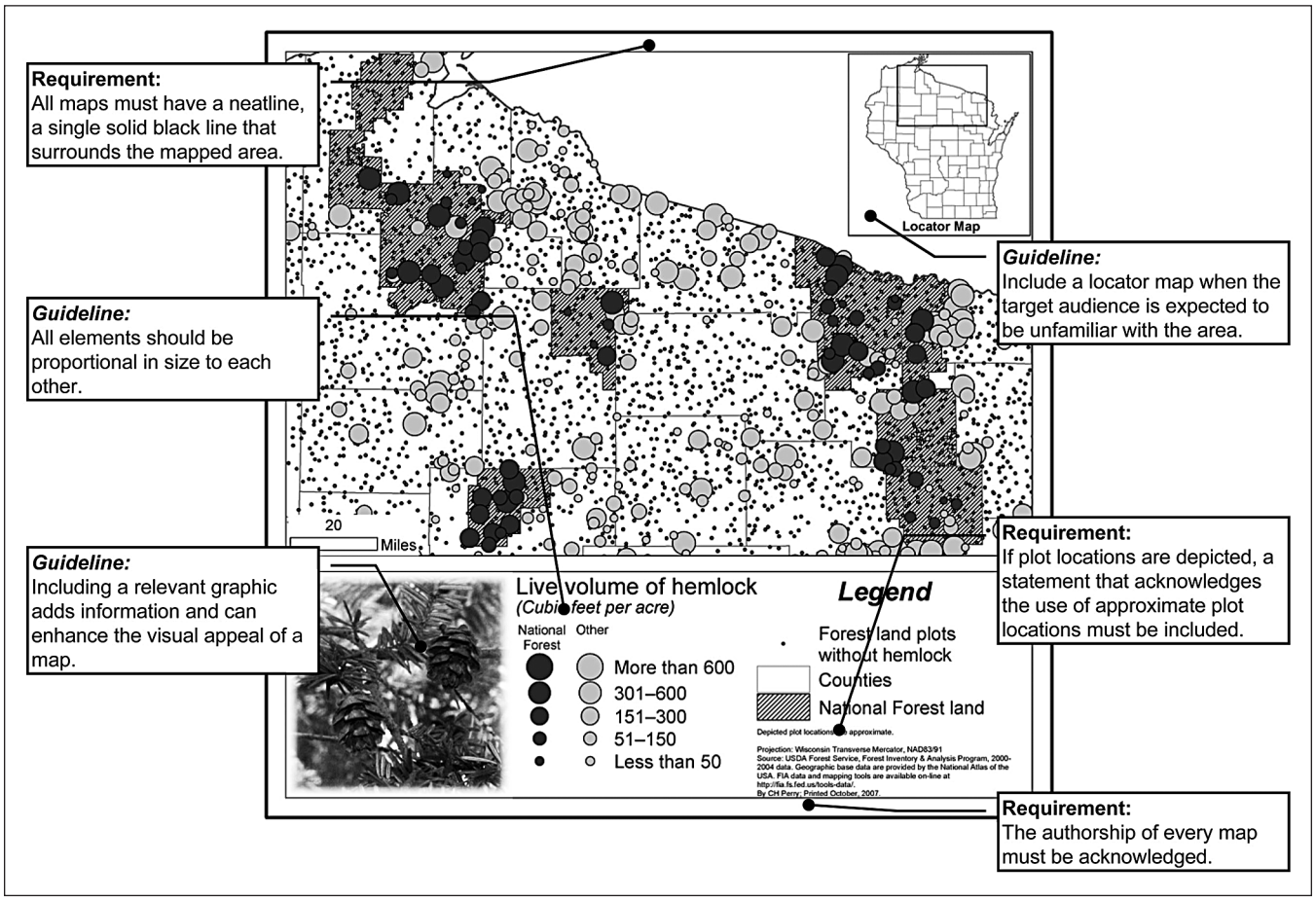


Figure 4.—*A subset of the proposed cartographic standards (three requirements and three guidelines) using a dot map for illustration.*



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