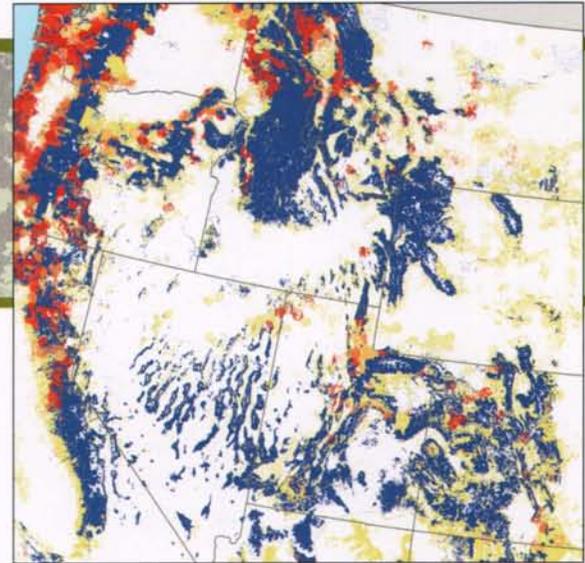




Public and private forest ownership in the conterminous United States

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Forests and the goods and services they provide are influenced by both the biophysical and human environments. To fully understand forest ecosystems, we need to understand the social context in which forests exist because landowners determine land use and management practice. To influence decisions related to the forests, we need to understand the spatial distribution of forest ownership.

The U.S. Department of Agriculture (USDA), Forest Service's Forest Inventory and Analysis (FIA) program collects annual information on the status, health, and trends of forests across all land ownerships. As the nation's forest census, the FIA program develops map products on the social, biophysical, and economic state of our forests. Further, FIA's National Woodland Owner Survey gathers additional information on forest owners' demographics, values, concerns, intentions, and uses of their land.

The maps in this chapter depict public and private forest landownership in the conterminous United States. They were produced by combining forest type maps from the forest service with a protected areas database from the Conservation Biology Institute. In the upper map, private forests are further stratified by corporate ownership, using data from the Resources Planning Act (RPA) forest resource assessment. In this context, forest land is defined as land which is at least 10 percent stocked by forest trees of any size, including land that had such tree cover that will be naturally or artificially regenerated. Forests owned by an incorporated business are referred to as corporate forest land. Examples of incorporated businesses include integrated forest products companies, timber investment management organizations, and real estate investment trusts.

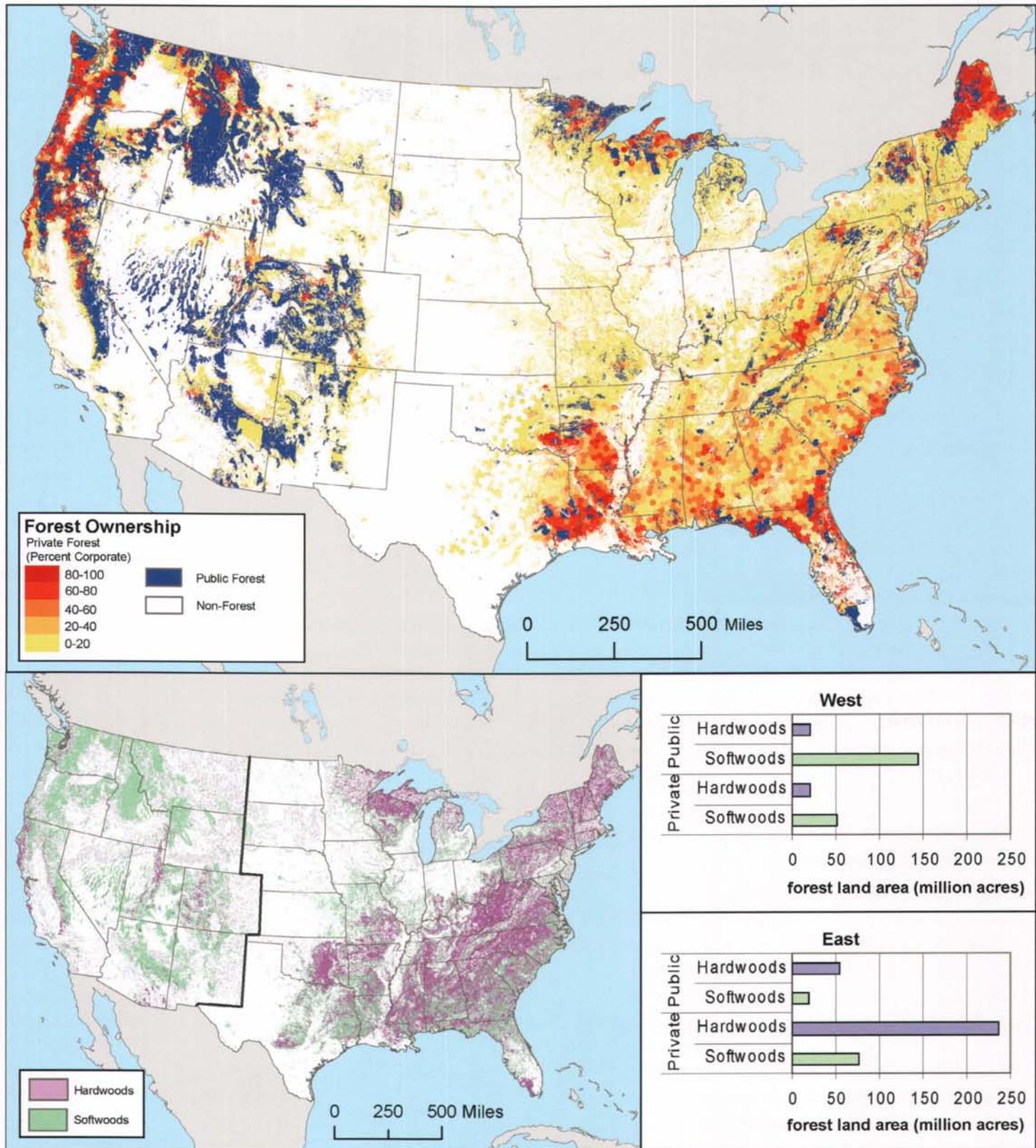
A visual solution

Misperceptions about the ownership of forests in the United States are widespread. A recent poll indicates that 60 percent of voters think forests are predominantly government-owned, and an additional 20 percent think forests are predominantly owned by forest industry companies. In reality, of the 751 million acres¹ (304 million hectares) of forest land in the United States, 56 percent (421 million acres or 170 million hectares) is privately owned. Only one-third of this privately owned land is held by corporations. A better understanding of the characteristics and distribution of forest ownership enables researchers, politicians, landowners, and interested citizens to make more informed decisions about the nation's natural resources. This map helps correct the misperceptions about forest ownership in the United States and highlights important regional differences. The maps and similar products are used in national, regional, and state-level forest assessments aimed at understanding current patterns and future trends in forest resources.

In the upper map, the percentage of private forest land in corporate ownership is summarized across a hexagon sampling array, which provides spatial information while maintaining landowner privacy. The lower map shows the spatial distribution of hardwoods and softwoods, with corresponding bar charts comparing the amount of forest land area (millions of acres) in eastern and western United States by ownership and forest type categories.

¹Smith, B., et al. 2009. Forest Resources of the United States, 2007. WO-78. Washington, D.C.: U. S. Department of Agriculture, Forest Service, Washington Office.

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Data courtesy of USDA Forest Service; U.S. EPA; Conservation Biology Institute; ESRI Data & Maps, 2006, from ArcWorld Supplement; ESRI Data & Maps, 2006, from ArcUSA, U.S. Census; ESRI Data & Maps, 2006, from ArcWorld.

Broad patterns are instantly apparent in the upper map, especially the contrast in the amount of private ownership (yellows and reds) in the East as compared to the amount of public ownership (blue) in the West. Also, note the concentrations of corporate private forest (red) which occur in parts of the Northeast, South, and Pacific Northwest.

The bar charts accompanying the lower map were designed so that the colors correspond with the hardwoods (purple) and softwoods (green) map categories. This allows the viewer to quickly associate the bars with the corresponding locations on the map. The bar charts highlight another striking regional difference: the West is composed primarily of softwoods held in public ownership; while the East is composed primarily of hardwoods held in private ownership.

Spatial analyses and maps of forest ownership are powerful tools for rectifying misperceptions about forest ownership, highlighting regional differences, and helping to inform not only public opinion, but public policy, for it is the owners of the forest land who will determine its future use.

Resource tables

Data dictionary

General data description	Data sources
Forest/nonforest softwood/hardwood	Forest Type Groups Map, USDA Forest Service. See the USDA Forest Service Remote Sensing Applications Center Web site.
Percent corporate forest ownership	Resources Planning Act (RPA) RPA data on forest ownership is derived mainly from the USDA Forest Service Forest Inventory and Analysis (FIA) program. For more info, see the FIA Web site.
Public land ownership	Conservation Biology Institute's Protected Areas Database, available from the Conservation Biology Institute Web site.
State boundaries, country boundaries, lakes	ESRI Data & Maps.
EMAP hexagons	Environmental Protection Agency. See the EPA Web site.

Software dictionary

Software	Description
ESRI ArcGIS Desktop	Cartographic layout and geoprocessing.
ArcInfo Workstation	GRID module for raster processing.
Microsoft Excel	Bar charts.

Additional resources

Resource	Description and source
Forest Inventory analyst	Able to retrieve, assemble, and process resource inventory data.
GIS specialist	Able to process raster datasets and design the cartographic layout.
ColorBrewer Web site: www.colorbrewer.org	Used to find information on color palettes.

Recipe for map-building success

The following steps outline our thought process and procedures for creating a successful map.

Step 1: Develop the question

Be very specific about what information needs to be communicated. We wanted to answer the question, “Who owns America’s forests?” and to rectify the erroneous perceptions about forest ownership.

Step 2: Identify the audience

For these maps, our audience was multitiered: policy makers, concerned citizens, forest landowners, and students.

Step 3: Decide if a map is appropriate

Is there a compelling reason to use a map rather than tables or charts? With regard to ownership, we decided a map quickly gives the user a sense of the amount of forest area in the broad ownership categories of public and private. Furthermore, the regional patterns are quite striking when displayed spatially. We also decided a broad audience would find a map more accessible than a series of tables.

Step 4: Assess data availability

RPA forest ownership data at sample locations was available for the conterminous United States. Using the built-in capabilities of ArcGIS, the forest service researchers were able to quickly transform ownership point data into a usable format and summarize the data on a hexagonal sampling frame, which also maintains landowner privacy. We elected to combine this data with publicly available nationwide datasets on forests (forest-type group) and public ownership (protected areas database from the Conservation Biology Institute).

Step 5: Determine map scale

We evaluated the range of scales/resolutions of the existing data and decided on a common scale.

We wanted to create a map at a continental scale and made a somewhat unconventional choice to intermingle pixel-based datasets with data that was summarized over a unit larger than the pixel. This choice accommodated our need for maintaining ownership privacy.

Step 6: Combine datasets

Datasets were combined via raster processing operations. We used numerous source datasets to create these maps and elected to combine everything into a single raster grid. This greatly simplified work during the cartographic design phase.

Step 7: Design an effective layout

We wanted to communicate several pieces of information: public versus private forest, percent corporate private ownership, hardwood versus softwood, and public hardwood/softwood versus private hardwood/softwood. Furthermore, we wanted to emphasize differences between forests in the East and the West. Early iterations attempted to combine this information in a single map using multiple diverging color ramps. Interpreting the map was difficult, especially when considering color-vision concerns, so we elected to use a pair of maps and complement them with bar charts.

Conclusion

The fusion of ownership data with remotely sensed forest cover data results in an informative, visually appealing, and unique national map that reveals spatial patterns of forest ownership in the United States. By using the Environmental Protection Agency’s Environmental Monitoring and Assessment Program’s (EMAP) hexagon sampling array we were able to spatially summarize and display plot-based corporate ownership data without disclosing private information about individuals or corporations.

These maps allow the viewer to quickly assess the drastic difference in the ownership patterns between various regions in the United States. The color palettes in the first map were selected to allow the user to easily distinguish between public and private, and the yellow-to-red ramp sharply contrasts private corporate ownership and family/individual ownership.

By including a pair of maps, more information could be communicated while still maintaining simplicity in each map. For example, the forests along the extreme western edge of the Sierra Nevada mountains in California are mostly privately owned (see upper map), and this privately owned area is dominated by hardwoods (see lower map). Such comparisons of the two maps allow viewers to discern how combinations of forest and nonforest cover, public-private ownership, individual-corporate ownership, and hardwood-softwood forests vary geographically.