Forest Inventory and Analysis Data for FVS Modelers

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Abstract—The USDA Forest Service, Forest Inventory and Analysis (FIA) program has been in continuous operation for over 70 years. FIA's primary objective is to determine the extent, condition, volume, growth, and depletion of timber on the Nation's forest land. To accomplish this objective, FIA collects sample plot information on all ownerships across the United States.

The Forest Inventory and Analysis Database (FIADB) (Miles and others 2001), was developed to provide users with a nationally consistent format for FIA data. FIADB files can be obtained for any State inventory conducted after 1988 for the Eastern United States or 1994 for the Western United States. All data in FIADB format can be exported into FVS-ready files for use in the Forest Vegetation Simulator (FVS) program. The FIA program is working with a variety of cooperators to develop alternative pathways for delivering FIA data to FVS users.

Introduction

The U.S. Forest Service Forest Inventory and Analysis (FIA) program has been reporting forest statistics for over 70 years. These reports are based on a statistical sample of field plots collected on all ownerships across the United States.

For clarity, FIA data are classified as being either "periodic" or "annual." Prior to 1999, states were periodically inventoried approximately every 10 years. Regional field crews would measure all of the plots in a state, then move on to the next state, only returning to the initial state when all other states in the region had been inventoried. Beginning in 1999, an annual inventory system was established where field crews are in every state every year. Under the annual system, from 10 to 20 percent of the plots in all states are measured each year. Currently, annual inventory data have been collected, and are available, for all states with the exception of Hawaii, Mississippi, New Mexico, Oklahoma, Wyoming, interior Alaska, and west Texas.

When the annual inventory system is fully implemented, there will be at least one sample plot taken for each 6,000 acres of forestland for the contiguous United States. This constitutes a pool of more than 125,000 plots. Each year approximately 15,000 to 20,000 of these plots will be re-measured. This field data, collected to national standards, with strict quality assurance/control standards, is in the public domain and can be freely obtained over the Internet.

Traditionally FIA data have been used to produce publications of forest statistics that could be used in policy analysis and strategic planning. Over the last 25 years an increase in computing power and data storage and distribution capabilities has led to an increase in the use and application of FIA data. Tools such as the Forest Inventory Mapmaker program (Miles 2001) have been developed that allow users to query the FIA database over the Internet to produce customized reports. Currently over 24,000 queries are completed annually using the Forest Inventory Mapmaker program.

Power users, who use FIA data in sophisticated analyses, have requested that FIADB formatted data be made available over the web. Last year nearly 8,000 FIADB State inventories were downloaded via the FIA Data Mart website. GIS users have requested that FIA data be provided in formats that meet their needs. To that end, GIS users can now download summarized FIA data in ESRI© shapefile format and are doing so at a rate of over 900 downloads per year. FVS users have similarly requested that FIA data be summarized in an FVS-ready format. This paper briefly describes the FIA dataset and efforts to provide FIA data in a format that will meet the needs of the FVS community.

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FIA Data Availability _____

Annual Inventory Data

The annual inventory sampling design is fully documented elsewhere (Bechtold and Patterson 2005). A brief description is provided here. A grid was superimposed over the entire United States. Each cell in the grid is approximately 6,000 acres in size. Under a single intensity survey, a single plot is randomly located in each grid cell (in some cases double or triple intensity surveys have been implemented when additional funding was provided by a State or other land management agency). Field plots are established and monumented on all forested plots. An area is considered forested if it is at least one acre in size, at least 120 feet wide and at least 10 percent stocked with trees or recently stocked with trees; recently burned over areas and harvested lands are considered forestland unless there is evidence that the plot will be put to a different land use.

Field crews establish four 1/24th-acre subplots at each plot location on which trees 5 inches in diameter will be measured. Seedlings and saplings, defined as trees less than 5 inches in diameter, are measured on four 1/300th-acre microplots. Optionally, four 1/4th-acre macroplots can be used to measure large diameter trees (currently only used in parts of the West for trees 24 inches in diameter and larger).

Periodic Inventory Data

Data collected prior to the implementation of the annual inventory system is referred to as periodic data. These data were collected using a variety of sampling designs. In most cases variable radius plots were used. Users should contact the appropriate regional FIA unit for additional information regarding the sampling design used in their periodic inventories.

Availability of Annual and Periodic Data

All core field data are processed and then stored in the FIADB with the exception of the exact plot locations and specific ownership information. The latitude and longitude stored in the FIADB is correct within at least one mile for at least 95 percent of the plots. Up to, but generally far less than, five percent of the plots in a county may have their plot locations switched with other similar plots in the county. These procedures are commonly referred to as "fuzzing and swapping" and are required to meet FIA's legal requirements to retain landowner confidentiality while providing as much data as possible to the public.

The FIADB currently contains only data that are collected consistently nation-wide. Regional add-ons to the national program are not currently in the FIADB. Many regional add-ons will be available in the next version of the FIADB slated for release in the summer of 2007.

FIADB formatted data and information about changes to the format can be found at www.fia.fs.fed.us. Data currently available for downloading are identified in table 1.

Distribution of FIA Data in FVS-Ready Format _____

Currently there are two primary methods of delivering data to FVS users. Forest Service personnel have access to FIA data through the Natural Resource Information System (NRIS) while non-Forest Service users have access to FIA data through the Forest Inventory Mapmaker program.

The Forest Inventory Mapmaker program has a module that allows users to download FIA data in FVS-ready format. The Mapmaker program can be accessed on the Internet at the following link http://www.ncrs2.fs.fed.us/4801/fiadb/fim21/wcfim21.asp. To generate data in FVS-ready format the user will need to:

1. Select the report type: Forest Vegetation Simulator (FVS) ready dump files.
2. Select the geographic area of interest: (for example, Alabama and Georgia).
3. Specify any filter options (for example, Forest type, ownership, stand age).
4. Select the appropriate FVS variant (for example, SE = Southeast states).
5 Enter a project name.

Table 1—FIA data availability by inventory year as of March 2007.

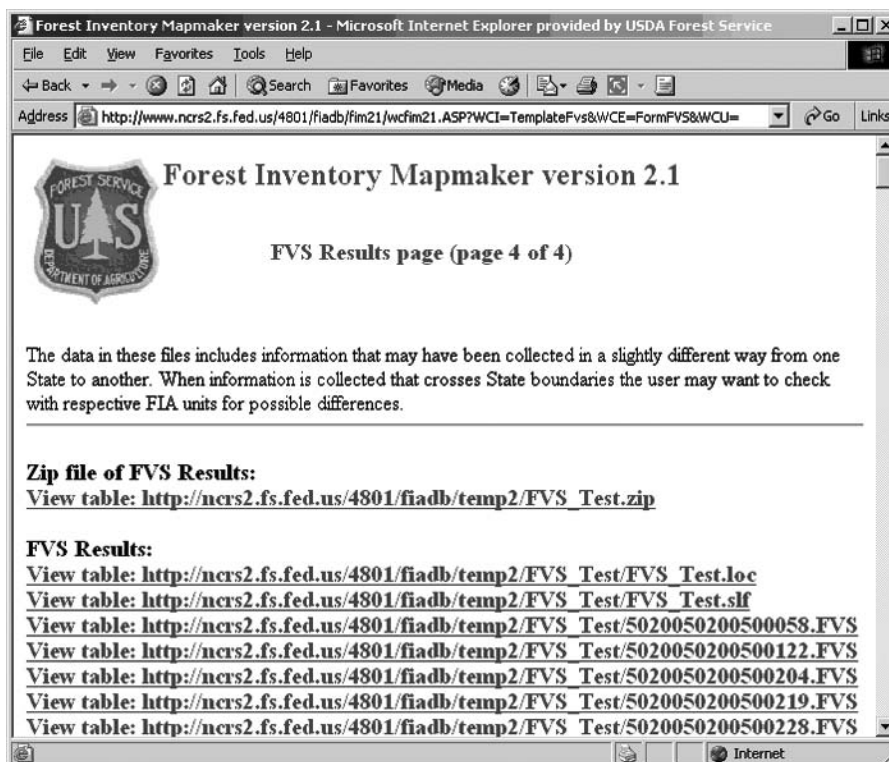| State	Periodic inventories	Initial annual inventory	Re-measured annual inventories
ALABAMA	1990, 2000	2001–2005	
ALASKA (coastal)	1998	2004–2005	
ARIZONA	1985, 1999	2001–2005	
ARKANSAS	1995	2002–2005	
CALIFORNIA	1994	2001–2005	
COLORADO	1984	2002–2005	
CONNECTICUT	1985, 1998	2003–2005	
DELAWARE	1986, 1999	2004	
FLORIDA	1987, 1995	2003–2005	
GEORGIA	1989, 1997	1998–2004	
IDAHO	1991	2004–2005	
ILLINOIS	1985, 1998	2001–2005	
INDIANA	1986, 1998	1999–2003	2004–2005
IOWA	1990	1999–2003	2004–2005
KANSAS	1981, 1994	2001–2005	
KENTUCKY	1988	2000–2004	
LOUISIANA	1991	2001–2005	
MAINE	1995	1999–2003	
MARYLAND	1986, 1999	2004	
MASSACHUSETTS	1985, 1998	2003–2005	
MICHIGAN	1980, 1993	2000–2004	2005
MINNESOTA	1977, 1990	1999–2003	2004–2005
MISSISSIPPI	1994		
MISSOURI	1989	1999–2003	2004–2005
MONTANA	1989	2003–2005	
NEBRASKA	1983, 1994	2001–2005	
NEVADA	1989	2004–2005	
NEW HAMPSHIRE	1983, 1997	2002–2005	
NEW JERSEY	1987, 1999	2004	
NEW MEXICO	1987, 1999		
NEW YORK	1993	2003–2004	
NORTH CAROLINA	1984, 1990	2002	
NORTH DAKOTA	1980, 1995	2001–2005	
OHIO	1991	2001–2004	
OKLAHOMA	1993		
OREGON	1992, 1999	2001–2005	
PENNSYLVANIA	1989	2000–2004	
RHODE ISLAND	1985, 1998	2003–2005	
SOUTH CAROLINA	1986, 1993	1999–2001	2002–2005
SOUTH DAKOTA	1980, 1995	2001–2005	
TENNESSEE	1989, 1999	2000–2004	
TEXAS	1992	2001–2005	
UTAH	1993	2000–2005	
VERMONT	1983, 1997	2003–2005	
VERMONT	1997	2003–2005	
VIRGINIA	1984, 1992	1998–2001	2002–2005
WASHINGTON	1991	2002–2005	
WEST VIRGINIA	1989, 2000	2004	
WISCONSIN	1983, 1996	2000–2004	2005
WYOMING	1984, 2000		

Figure 1—Example output from Forest Inventory Mapmaker program.

The module will then return a web page (fig. 1) containing links to the resulting FVS-ready files. These files include the standard FVS .loc (location), .slf (stand list), and .fvs (tree input) files.

Results _____

Over the past four years 2,386 retrievals of FIA data in FVS format (table 2) have been completed. Nearly all of these retrievals have been for geographic areas defined by state or county boundaries. Only 50 retrievals have made use of the feature allowing the user to define their geographic area of interest as a circle or polygon. This suggests that users may be retrieving entire FIA State datasets and performing additional filtering of the data using GIS software and or programs such as Pre-Suppose (Vandendriesche and Miles 2005).

More than half (1,246) of the Forest Inventory Mapmaker FVS-ready data retrievals employed some degree of filtering. The most common filter was to restrict the data retrieved to plots of specific ownerships (465 retrievals) and national forests (363). Filtering by forest types (410 retrievals) and stand age (148) was also common.

Retrievals have been made for all 48 contiguous states (fig. 2). More than 100 retrievals have been completed using data from the inventories of Maine, Wisconsin, Oregon, Montana, California, Michigan, Minnesota and Colorado.

Table 2—FVS-ready retrievals by retrieval type.

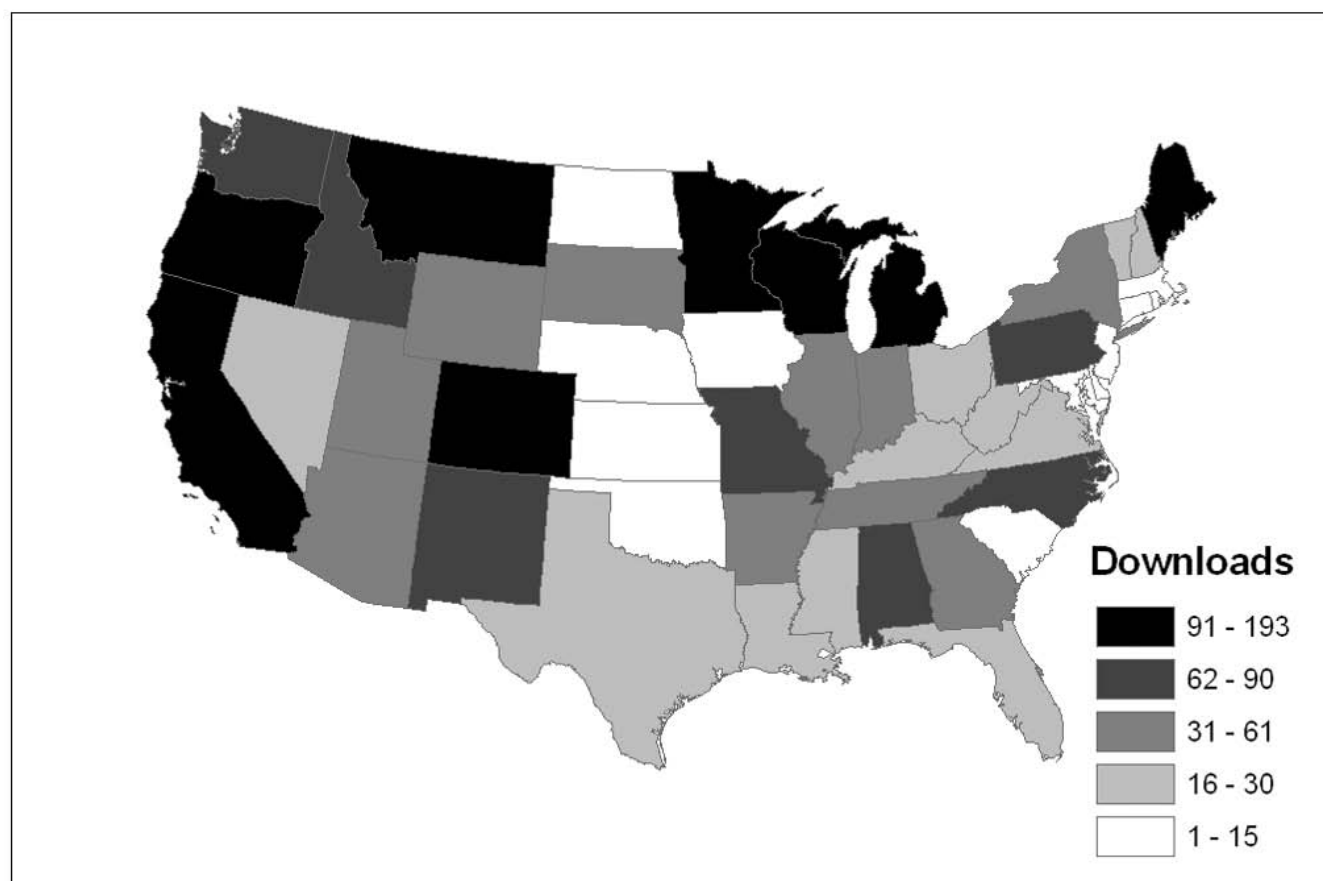| Retrieval type	Number
Circle	33
Polygon	17
State/county	2336
Total	2386

Figure 2—FVS retrievals by state

Conclusion_____

FVS users of FIA data make up a small but extremely important part of the overall FIA user community. It is important to maintain the delivery of FIA data to this user group.

An opportunity exists to redesign and improve the delivery of FIA data to the FVS community. The Forest Inventory Mapmaker program will soon be replaced by the Forest Inventory Data On-line (FIDO) suite of programs. FIDO is based on web services technology making it possible to deliver FIA data directly to other web-enabled programs. The transfer of FIA data to FVS could be streamlined by bypassing the need to create text files.

References _____

Bechtold, William A.; Patterson, Paul L., eds. 2005. The enhanced forest inventory and analysis program—national sampling design and estimation procedures. Gen. Tech. Rep. SRS-80. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 85 p.

Miles, Patrick D.; Brand, Gary J.; Alerich, Carol L.; Bednar, Larry F.; Woudenberg, Sharon W.; Glover, Joseph F.; Ezzell, Edward N. 2001. The forest inventory and analysis database: database description and users manual version 1.0. Gen. Tech. Rep. NC-218. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 130 p.

Miles, Patrick D. 2001. Forest Inventory Mapmaker users guide. Gen. Tech. Rep. NC-221. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 52 p.

Vandendriesche, Donald A.; Miles, Patrick D. 2005. Forest planning using forest inventory and analysis data and the Forest Vegetation Simulator. Proceedings; 2005 Society of American Foresters Annual Convention; Fort Worth, TX. 10 p.